IS 10613 (2004): Cycles - Safety requirements for bicycles (Amalgamating IS 10616) [TED 16: Bicycles]

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IS 10613 : 2004
ISO 4210 : 1996
(Amalgamating IS 10616 : 1983)

भारतीय मानक

साइकिल — साइकिलों के लिए सुरक्षा अपेक्षाएँ

(पहला पुनरीक्षण)

Indian Standard

CYCLES — SAFETY REQUIREMENTS FOR BICYCLES

(First Revision)

ICS 43.150

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Price Group 13

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with ISO 4210 : 1996 'Cycles — Safety requirements for bicycles' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Bicycles Sectional Committee and approval of the Transport Engineering Division Council.

IS 10613 : 1983 'Specification for bicycles' was first published in 1983. Methods of tests were covered in IS 10616 : 1983 'Methods of tests for bicycle and sub-assemblies'. This revision has been taken by amalgamating it with IS 10613, in order to harmonize with International Standard ISO 4210 : 1996.

The text of the International Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

In this adopted standard reference appears to certain International Standards listed below for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their place, are given below along with their degree of equivalence for the editions indicated. However, that International Standard cross referred in this adopted ISO Standard, which has subsequently been revised, position in respect of latest ISO Standard has been given:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 5775-1 : 1997 Bicycle tyres and rims — Part 1 : Tyre designations and dimensions	IS 2414 : 1991[1)] Cycle and rickshaw pneumatic tyres — Specification (*third revision*)	Technically equivalent
ISO 5775-2 : 1996 Bicycle tyres and rims — Part 2 : Rims	IS 624 : 2003 Bicycles — Rims — Specification (*fourth revision*)	do
ISO 6742-2 : 1985 Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 2 : Retro-reflective devices	IS 7599 : 1975 Reflex reflectors for cycles	—
ISO 9633 : 2001 Cycle chains — Characteristics and test methods	IS 1283 : 1995 Bicycle freewheels and chains (*second revision*)	Technically equivalent

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of the ISO 6742-1 and ISO 7636 and decided that they are acceptable for use in conjunction with this standard.

For BIS Certification Marking, details are available with the Bureau of Indian Standards.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1) Under revision.

Indian Standard

CYCLES — SAFETY REQUIREMENTS FOR BICYCLES

(First Revision)

Section 1: General

1.1 Scope

This International Standard specifies safety and performance requirements for the design, assembly and testing of bicycles and sub-assemblies, and lays down guidelines for instructions on the use and care of bicycles.

It applies to bicycles intended for use on public roads, and on which the saddle can be adjusted to provide a saddle height of 635 mm or more.

It does not apply to specialized types of bicycle such as tradesmen's delivery bicycles, tandems, toy bicycles and bicycles designed and equipped for use in sanctioned competitive events.

1.2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5775-1:1994, *Bicycle tyres and rims — Part 1: Tyre designations and dimensions.*

ISO 5775-2:1989, *Bicycle tyres and rims — Part 2: Rims.*

ISO 6742-1:1987, *Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 1: Lighting equipment.*

ISO 6742-2:1985, *Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 2: Retro-reflective devices.*

ISO 7636:1984, *Bells for bicycles and mopeds — Technical specifications.*

ISO 9633:1992, *Cycle chains — Characteristics and test methods.*

1.3 Definitions

For the purposes of this International Standard, the following definitions apply.

1.3.1 cycle: Any vehicle that has at least two wheels and is propelled solely by the muscular energy of the person on that vehicle, in particular by means of pedals.

1.3.2 bicycle: Two-wheeled cycle.

1.3.3 delivery bicycle: Bicycle designed for the primary purpose of carrying goods.

1.3.4 tandem: Bicycle with saddles for two or more riders, one behind the other.

1.3.5 saddle height: Dimension from the ground plane to the top of the saddle, measured in the centre of the seating area normal to the ground plane when the bicycle is upright.

1.3.6 braking distance: Distance travelled by a bicycle between the commencement of braking (1.3.7) and the point at which the bicycle comes to rest.

1.3.7 commencement of braking: Point on the test track at which the brake actuating mechanism is moved from its rest position. In tests with two brakes, this point is determined by the first mechanism to operate.

1.3.8 gear development: Distance travelled by a bicycle during one revolution of the pedal cranks.

1.3.9 exposed protrusion: Protrusion that can be contacted by the central 75 mm of the lateral surface of a cylinder 250 mm long and 83 mm in diameter (simulating a limb). See figure 1.

1.3.10 (pedal) tread surface: Surface of a pedal that is presented to the underside of the foot, the design of which incorporates a slip-resistant characteristic.

1.3.11 ferrous component: Component composed of structural members made entirely from ferrous materials excluding any jointing media such as brazing materials or adhesives.

1.3.12 non-ferrous component: Component composed of structural members made entirely from non-ferrous materials excluding any jointing media such as adhesives.

NOTE — For the purposes of the choice of fatigue test forces, any component made from a mixture of ferrous and non-ferrous members shall be classified as non-ferrous.

1.3.13 crank assembly: Crank assembly for fatigue testing consists of the two cranks, the pedal spindles, the bottom bracket spindle, and the first component of the drive system, e.g. chainwheel.

Dimensions in millimetres

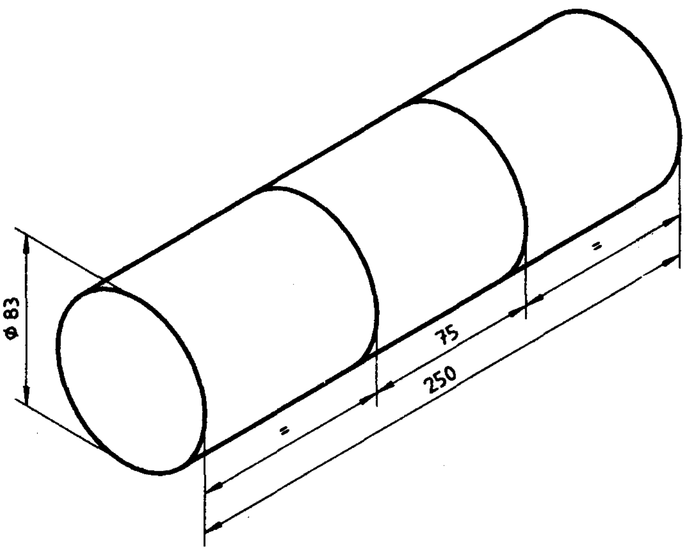


Figure 1 — Exposed protrusion test cylinder

Section 2: Requirements of sub-assemblies

2.1 General

2.1.1 Sharp edges

Exposed edges that could come into contact with the rider's hands, legs, etc., during normal riding or normal handling and normal maintenance shall not be sharp.

2.1.2 Protrusions

Any rigid exposed protrusion longer than 8 mm after assembly shall terminate in a radius of not less than 6,3 mm. Such protrusions shall have a major end dimension greater than 12,7 mm and a minor end dimension greater than 3,2 mm.

There shall be no protrusions on the top tube of a bicycle frame between the saddle and a point 300 mm forward of the saddle, with the exception that control cables no greater than 6,4 mm in diameter and cable clamps made from material no thicker than 4,8 mm may be attached to the top tube.

Foam pads attached to the bicycle frame to act as protective cushions are permitted, provided that the bicycle meets the requirements for protrusions when the pads are removed.

A screw thread that is an exposed protrusion (1.3.9) shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

2.2 Brakes

2.2.1 Braking systems

A bicycle shall be equipped with two braking systems. One shall operate on the front wheel and one on the rear wheel. The braking systems shall operate without binding and shall be capable of meeting the braking performance requirements of 2.2.5.

Brake blocks containing asbestos shall not be permitted.

2.2.2 Hand-operated brakes

2.2.2.1 Brake lever position

Hand brake levers for front and rear brakes shall be positioned according to the legislation or custom and practice of the country in which the bicycle is to be sold.

2.2.2.2 Brake lever dimensions

The maximum grip dimension, d, measured between the outer surfaces of the brake lever and the handlebar, or the handlebar grip or any other covering where present, shall not exceed 90 mm between points A and B, and 100 mm between points B and C (see figure 2).

NOTE — The range of adjustment on the brake lever should permit these dimensions to be obtained.

2.2.2.3 Attachment of brake assembly

The screws used to attach a brake assembly to the frame, fork or handlebar shall be provided with suitable locking devices, for example a lock-washer, lock-nut or stiff-nut.

Cable pinch-bolts shall not sever any of the cable strands when assembled to the manufacturer's instructions. In the event of a brake cable failing, no part of the brake mechanism shall inadvertently inhibit the rotation of the wheel.

The cable end shall either be protected with a cap that shall withstand a removal force of 20 N or be otherwise treated to prevent unravelling.

Dimensions in millimetres

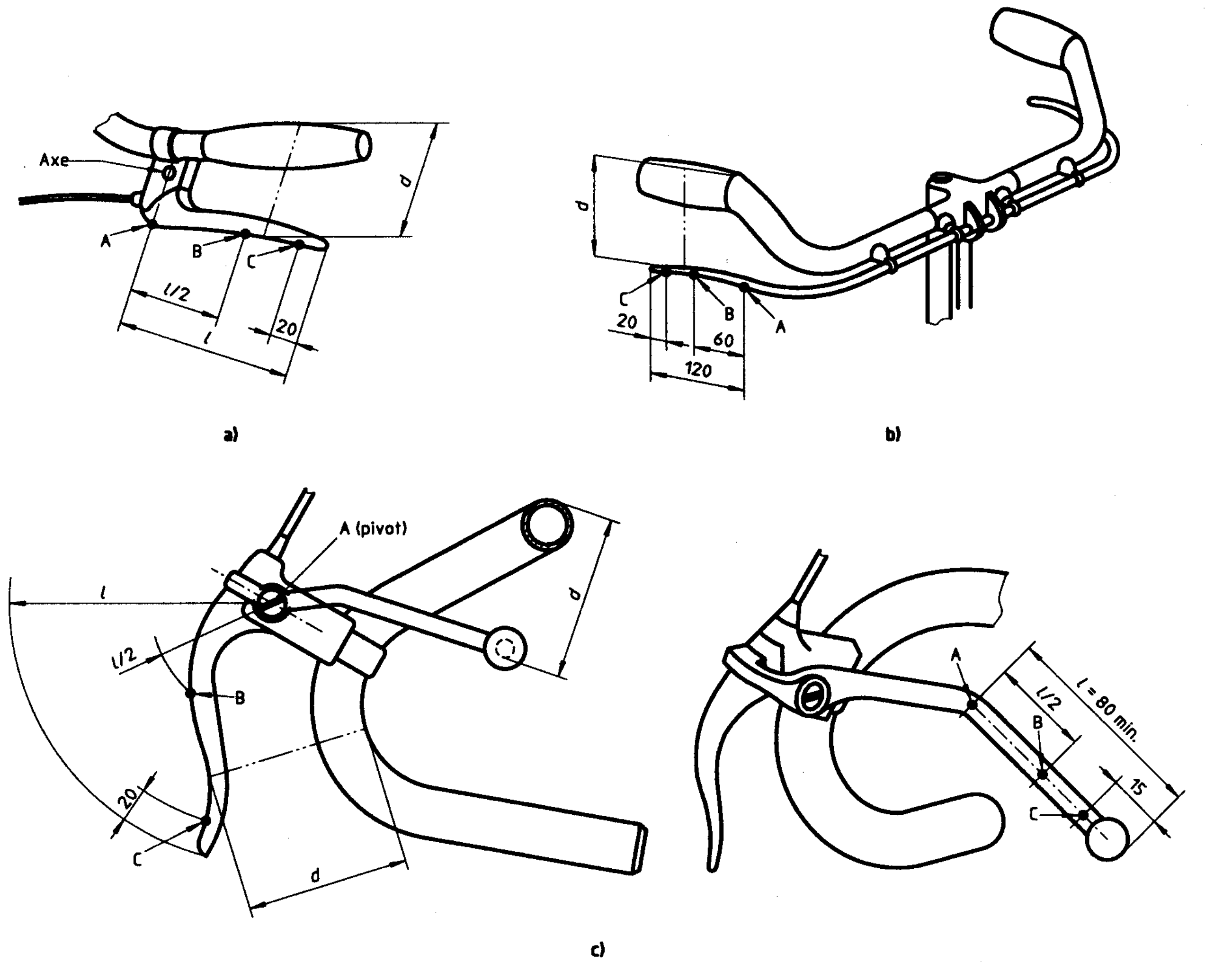


Figure 2 — Brake lever grip dimensions

2.2.2.4 Brake block assembly

The brake block shall be securely attached to the backing plate or holder and there shall be no failure of the block assembly when tested by the method specified in 4.1. The brake system shall be capable of meeting the strength test specified in 2.2.4.1 and the braking performance requirements of 2.2.5.1 and 2.2.5.2 after completion of the test specified in 4.1.

2.2.2.5 Brake adjustment

The brakes shall be capable of adjustment to an efficient operating position until the brake blocks have worn to the point of requiring replacement as recommended in the literature provided by the manufacturer.

When correctly adjusted, the brake block shall not contact anything other than the intended braking surface.

The brake blocks of a bicycle with rod brakes shall not come into contact with the rim of the wheels when the steering angle of the handlebars is set at 60°, nor shall the rods bend, or be twisted after the handlebars are reset to the central position.

2.2.3 Back-pedal brakes

The brake shall be actuated by the operator's foot applying force to the pedal in a direction opposite to that of the drive force. The brake mechanism shall function independently of any drive-gear positions or adjustments. The differential between the drive and brake positions of the crank shall not exceed 60°. The measurement shall be taken with the crank held against each position with a torque of at least 14 N · m.

2.2.4 Strength of brake system

2.2.4.1 Hand-operated brakes

When tested by the method described in 4.2.1, there shall be no failure of the brake system or of any component thereof.

2.2.4.2 Back-pedal brakes

When tested by the method described in 4.2.2, there shall be no failure of the brake system or any component thereof.

2.2.5 Braking performance

2.2.5.1 Braking under dry conditions

When tested by the method described in 4.3, a bicycle shall be brought to a smooth safe stop within the relevant distances and from the relevant velocities given in table 1.

2.2.5.2 Braking under wet conditions

When tested by the method described in 4.3, a bicycle shall be brought to a smooth safe stop within the relevant distances and from the relevant velocities given in table 1.

Table 1 — Brake test velocities and braking distances

Condition	Velocity km/h	Brakes in use	Braking distance m
Dry	25	Both	7
		Rear only	15
Wet	16	Both	9
		Rear only	19

2.2.5.3 Extension levers

Where a bicycle is fitted with extension levers, separate tests shall be conducted for the operation of the extension levers in addition to tests using the normal levers to which the extensions are attached.

2.2.5.4 Linearity of back-pedal brake

When tested by the method described in 4.4, the brake force shall be linearly proportional (within ± 20 %) for a pedal force from 90 N to 300 N and shall be not less than 150 N for a pedal force of 300 N.

2.3 Steering

2.3.1 Handlebars

The handlebars shall have an overall width between 350 mm and 700 mm. The vertical distance between the top of the handlebar grips, when assembled to the highest riding position according to the manufacturer's instructions, and the seat surface of the saddle in its lowest position shall not exceed 400 mm.

The ends of the handlebars shall be fitted with handgrips or end plugs that will withstand a removal force of 70 N.

2.3.2 Handlebar stem

The handlebar stem shall contain a permanent mark that clearly indicates the minimum insertion depth of the handlebar stem into the fork stem, or alternatively a positive and permanent means of ensuring the minimum insertion depth shall be provided. The insertion mark, or insertion depth, shall be not less than 2,5 times the shaft diameter from the lower end of the stem, and there shall be at least one shaft diameter's length of contiguous circumferential shaft material below the mark. An insertion mark shall not affect the strength of the handlebar stem.

2.3.3 Expander bolt for handlebar stem

The minimum failure torque of the bolt shall be at least 50 % greater than the manufacturer's maximum tightening torque.

2.3.4 Steering stability

The steering shall be free to turn through at least 60° either side of the straight-ahead position and shall exhibit no tight spots, stiffness or slackness in the bearings when correctly adjusted.

A minimum of 25 % of the total mass of the bicycle and rider shall act on the front wheel when the rider is holding the handlebar grips and sitting on the saddle, with the saddle and rider in their most rearward positions.

Recommendations for steering geometry are given in annex B.

2.3.5 Strength of steering assembly

The handlebar stem shall be capable of withstanding without fracture the tests described in 4.5.1.1 and 4.5.1.2.

When tested by the method described in 4.5.2, there shall be no movement of the handlebar relative to the stem.

When tested by the method described in 4.5.3, there shall be no movement of the handlebar stem relative to the fork stem other than that movement required to take up tolerances before any locking faces abut. Such movement shall not exceed 5°.

2.3.6 Fatigue test on handlebar and stem assembly

When tested by the method described in 4.5.4, there shall be no fractures or visible cracks in the handlebar or stem.

NOTE — It is recommended that standardized crack inspection methods are used, such as those contained in ISO 3452. This recommendation applies to all crack test requirements in this International Standard.

2.4 Frame-fork assembly

2.4.1 Impact test (falling mass)

When tested by the method described in 4.6.1, there shall be no visible evidence of fracture, and the permanent deformation of the assembly, measured between the centrelines of the wheel axles (wheelbase), shall not exceed 40 mm.

2.4.2 Impact test (falling frame-fork assembly)

When tested by the method described in 4.6.2, there shall be no visible evidence of fracture.

2.5 Front fork

2.5.1 Means of location

The slots or other means of location for the front wheel axle within the front fork shall be such that when the axle or cones are firmly abutting the top face of the slots, the front wheel remains central within the front fork.

2.5.2 Fatigue strength of fork

When tested by the method described in 4.6.3 there shall be no fracture or visible cracks on any part of the fork.

2.6 Wheels

2.6.1 Rotational trueness

Rotational trueness is defined in ISO 1101 in terms of circular run-out tolerance (axial). The run-out tolerances given in 2.6.1.1 and 2.6.1.2 represent the maximum permissible variation of position of the rim (i.e. full indicator reading) of a fully assembled wheel during one complete revolution about the axle without axial movement.

2.6.1.1 Concentricity tolerance

For bicycles equipped with rim brakes, the run-out shall not exceed 2 mm when measured perpendicular to the axle at a suitable point along the rim. (See figure 3.)

For bicycles not equipped with rim brakes, the run-out shall not exceed 4 mm.

2.6.1.2 Squareness tolerance

For bicycles equipped with rim brakes, the run-out shall not exceed 2 mm when measured parallel to the axle at a suitable point along the rim. (See figure 3.)

For bicycles not equipped with rim brakes, the run-out shall not exceed 4 mm.

2.6.2 Clearance

Alignment of the wheel assembly in a bicycle shall allow not less than 2 mm clearance between the tyre and any frame or fork element.

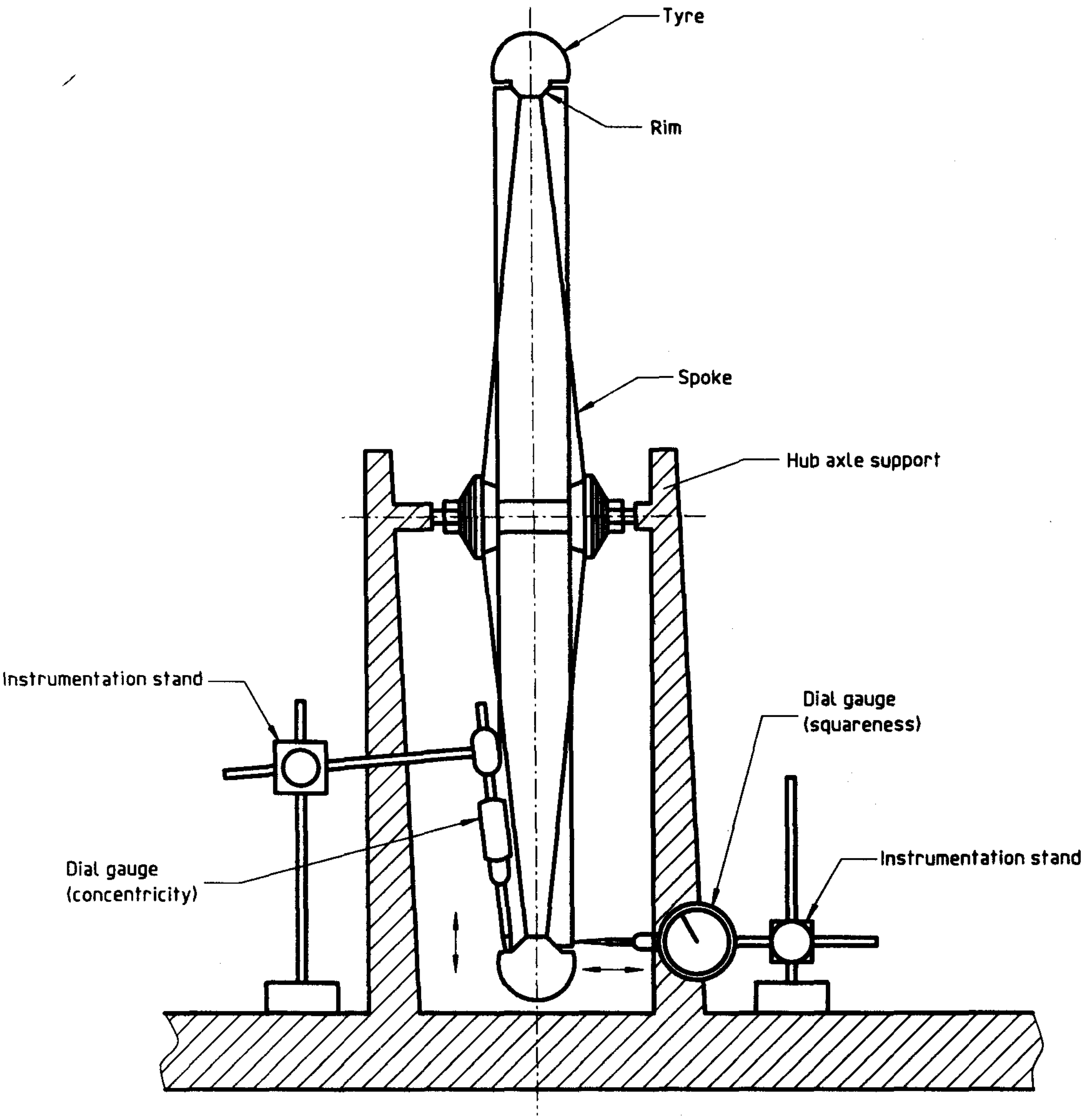


Figure 3 — Wheel rotational trueness

2.6.3 Static load test

When a fully assembled wheel is tested by the method described in 4.7, there shall be no failure of any of the components of the wheel, and the permanent deformation, measured at the point of application of the force on the rim, shall not exceed 1,5 mm.

2.6.4 Wheel retention

2.6.4.1 General

Wheels shall be secured to the bicycle frame and fork such that when adjusted to the manufacturer's recommendations they comply with 2.6.4.2, 2.6.4.3, 2.6.4.4 and 2.6.5.

Wheel nuts shall have a minimum removal torque of 70 % of the manufacturers recommended tightening torque. Where quick-release axle mechanisms are used they shall comply with 2.6.5.

2.6.4.2 Front wheel retention — retention devices secured

There shall be no relative motion between the axle and the front fork when a force of 2 300 N is applied symmetrically to either side of the axle for a period of 30 s in the direction of the removal of the wheel.

2.6.4.3 Rear wheel retention — retention devices secured

There shall be no relative motion between the axle and the frame when a force of 2 300 N is applied symmetrically to either side of the axle for a period of 30 s in the direction of the removal of the wheel.

2.6.4.4 Front wheel retention — retention devices unsecured

Where threaded axles and nuts are fitted, and the nuts are unscrewed by a least 360° from the finger tight condition, the wheel shall not detach from the fork when a force of 100 N is applied radially outwards and in line with the drop out slots.

Where quick release mechanisms are fitted the requirements in 2.6.5.2 shall apply.

2.6.5 Quick release axle mechanisms

2.6.5.1 Operating features

Any quick-release mechanism shall have the following operating features:

a) the quick-release mechanism shall be adjustable to allow setting for tightness [see 2.16 c)];

b) its form and marking shall clearly indicate whether the mechanism is in the open or locked position;

c) if adjustable by a lever, the force required to close a properly set lever shall not exceed 200 N and, at this closing force, there shall be no permanent deformation of the quick-release mechanism;

d) the releasing force of the clamping mechanism when closed shall not be less than 50 N;

e) if operated by a lever, the quick-release mechanism shall withstand without fracture or permanent deformation a closing force of not less than 250 N applied with the adjustment set to prevent full closure under this force;

f) the wheel retention with the quick-release mechanism in the clamped position shall be in accordance with 2.6.4.2 and 2.6.4.3.

If applied to a lever, the forces specified in c), d) and e) shall be applied 5 mm from the tip end of the lever.

2.6.5.2 Removal

It shall be possible to remove and replace the wheel without disturbing the preset condition when secondary devices are not present. When a secondary device is present, and the quick release lever is fully open and the brake system is disconnected or released, the wheel shall not detach from the fork when a force of 100 N is applied to the wheel radially outward and in line with the drop out slots.

NOTE — It is recommended that it be possible to remove and replace the wheel without disturbing the preset condition when secondary devices are present.

2.7 Rims, tyres and tubes

Non-moulded tyres are excluded from the requirements of 2.7.1 and 2.7.2.

2.7.1 Inflation pressure

The maximum inflation pressure recommended by the manufacturer shall be moulded on the sidewall of the tyre so as to be readily visible when the latter is assembled on the wheel.

2.7.2 Compatibility

Tyres shall comply with the requirements of ISO 5775-1 and rims shall comply with the requirements of ISO 5775-2. The tyre and tube shall be compatible with the rim design. When inflated to 110 % of the maximum inflation pressure for a period of not less than 5 min, the tyre shall remain intact on the rim.

2.8 Pedals and pedal/crank drive system

2.8.1 Pedal tread

2.8.1.1 The tread surface of a pedal shall be secured against movement within the pedal assembly.

2.8.1.2 Pedals intended to be used without toe-clips, or for optional use with toe-clips, shall have

a) tread surfaces on the top and bottom surfaces of the pedal, or

b) a definite preferred position that automatically presents the tread surface to the rider's foot.

2.8.1.3 Pedals designed to be used only with toe-clips or shoe retention devices shall have toe-clips or shoe retention devices securely attached and need not comply with the requirements given in 2.8.1.2 a) and b).

2.8.2 Pedal clearance

2.8.2.1 Ground clearance

With the bicycle unladen, the pedal at its lowest point and the tread surface of the pedal parallel to the ground and uppermost where it has only one tread surface, the bicycle shall be capable of being leaned over at an angle of 25° from the vertical before any part of the pedal touches the ground.

When a bicycle is equipped with a sprung suspension, this measurement shall be taken with the suspension in a depressed position such as would be caused by a rider weighing 85 kg.

2.8.2.2 Toe clearance

Bicycles not equipped with positive foot-retaining devices (such as toe-clips) shall have at least 89 mm clearance between the pedal and the front tyre or mudguard (when turned to any position). The clearance shall be measured forward and parallel to the longitudinal axis of the bicycle from the centre of either pedal to the arc swept by the tyre or mudguard, whichever results in the least clearance. (See figure 4.)

Where a bicycle front fork has features that are designed to permit the fitting of a front mudguard, the toe clearance shall be measured with a suitable mudguard so fitted.

2.8.3 Drive system static load test

When tested by the method described in 4.8.1, there shall be no visible fracture of any component of the drive system, and drive capability shall not be lost.

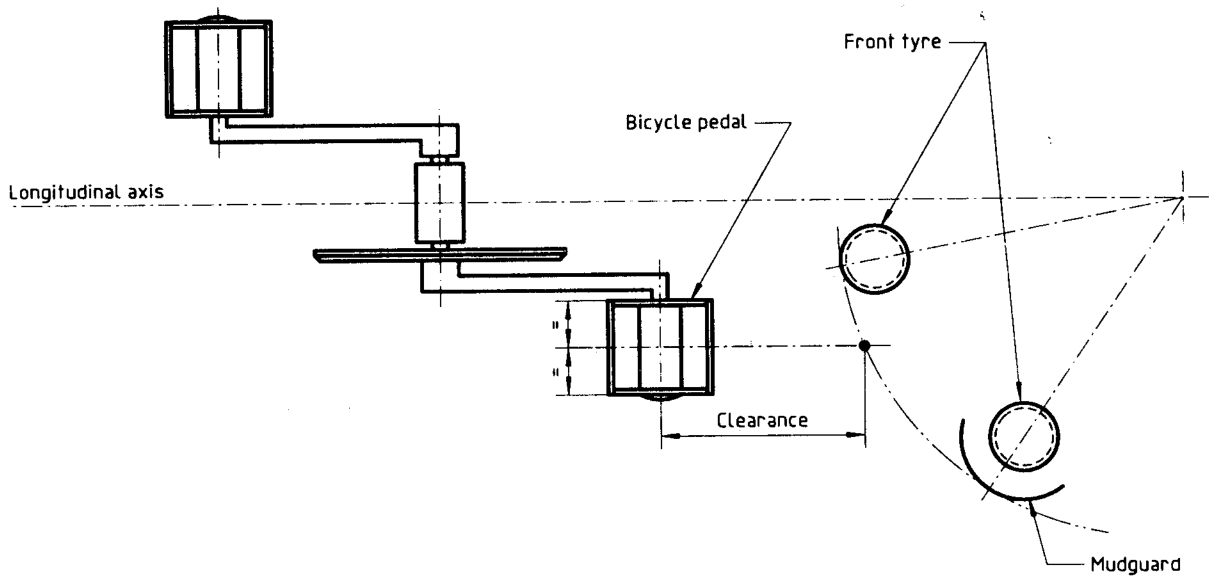


Figure 4 — Toe clearance

2.8.4 Pedal dynamic durability test

When tested by the method described in 4.8.2, there shall be no visible fracture of any part of the pedal or of the crank threads.

2.8.5 Fatigue test on crank assembly

When tested by the method described in 4.8.3, there shall be no fractures of, or visible cracks in, either of the pedal spindles, either of the cranks, the bottom-bracket spindle, or the attachment of the chainwheel (or other type of drive component).

2.9 Saddle

2.9.1 Limiting dimensions

No part of the saddle, saddle supports, or accessories attached to the saddle shall be more than 125 mm above the top saddle surface at the point where the saddle surface is intersected by the seat post axis.

2.9.2 Saddle pillar

The saddle pillar shall contain a permanent mark that clearly indicates the minimum insertion depth of the pillar into the frame. The insertion mark shall be located not less than two diameters of the pillar from the bottom of the pillar (where the diameter is the full diameter) and it shall not affect the strength of the pillar.

2.9.3 Saddles with adjustment clamps

When tested by the method described in 4.9.1, there shall be no movement of the saddle adjustment clamp in any direction with respect to the pillar, or of the pillar with respect to the frame.

2.9.4 Saddles without adjustment clamps

Saddles which are not clamped, but are designed to pivot in a vertical plane with respect to the pillar, shall be allowed to move within the parameters of the design and shall withstand the test described in 4.9.1 without failure.

2.9.5 Saddle strength

When tested by the method described in 4.9.2, using a force of 400 N, the steel wire chassis shall not disengage from the saddle cover and/or plastic moulding and there shall be no cracking nor permanent distortion of the saddle assembly.

2.9.6 Fatigue test on saddle pillar

When tested by the method described in 4.9.3, there shall be no fractures of, or visible cracks in, the saddle pillar.

2.10 Chain

Where a chain drive is used as a means of transmitting the motive force, the chain shall operate over the front and rear sprockets without binding.

The chain shall conform to the requirements of ISO 9633.

2.11 Chainguard

2.11.1 A bicycle shall be equipped with one of the following:

a) a chainwheel disc that conforms to 2.11.2; or

b) a protective device that conforms to 2.11.3; or

c) where fitted with positive foot retention devices on the pedals, a combined front gear change guide and protective device that conforms to 2.11.4.

2.11.2 A chainwheel disc shall exceed the diameter of the outer chainwheel, when measured across the tips of the teeth, by not less than 10 mm. (See figure 5.)

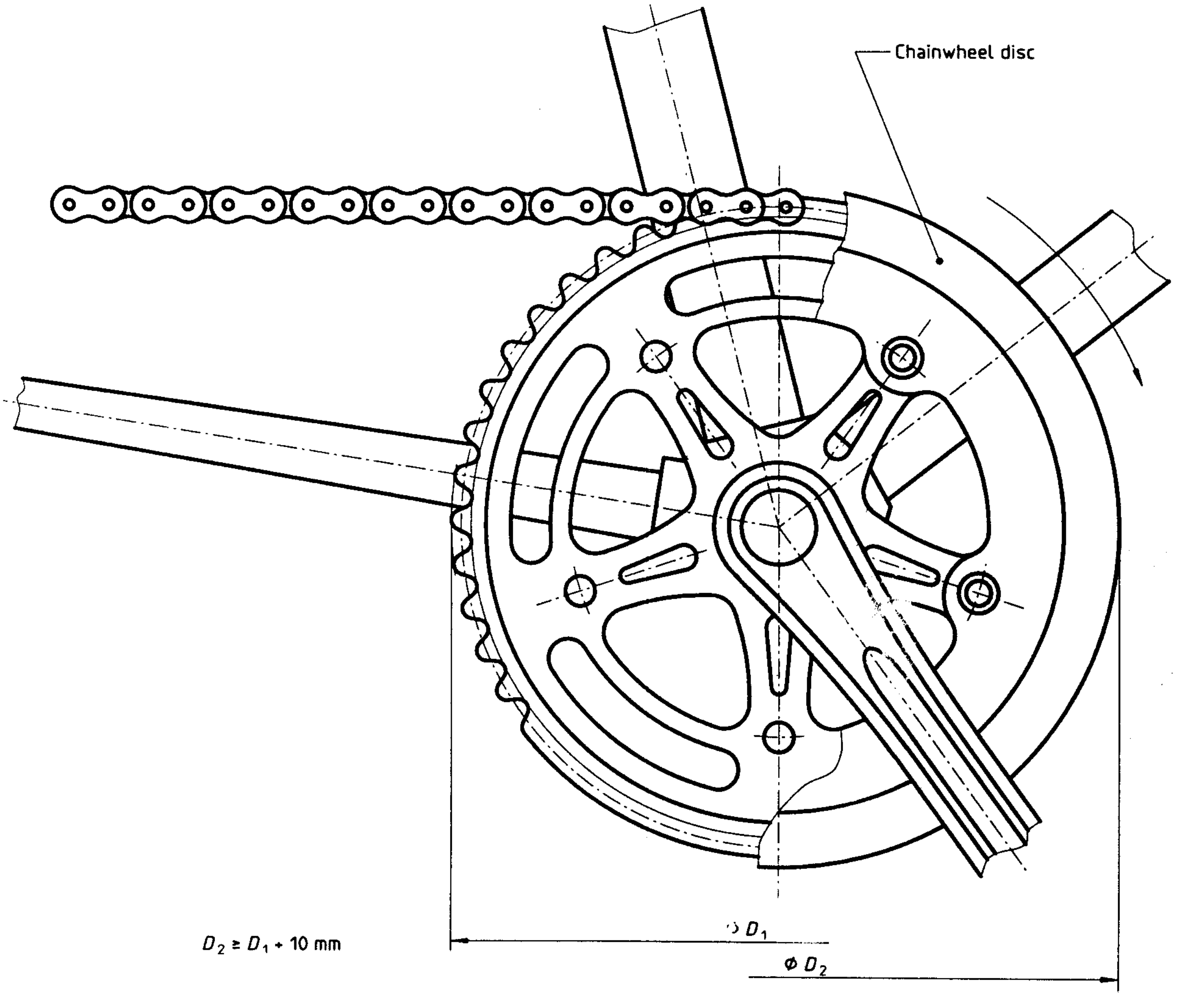


Figure 5 — Chainwheel disc

NOTE — Where the design is such that the pedal crank and chainwheel are too close together to accommodate a full disc, a partial disc may be fitted which closely abuts the pedal crank.

2.11.3 A protective device shall, as a minimum, shield the side plates and top surface of the chain and chainwheel for a distance of at least 25 mm rearwards along the chain from the point where the chainwheel teeth first pass between the side plates of the chain and forwards round the outer chainwheel to a horizontal line passing through the bottom bracket axle centre (see figure 6).

2.11.4 A combined front gear change guide and protective device shall, as a minimum, shield the outside face of the upper junction of the chain and outer chainwheel for a distance of at least 25 mm rearwards along the chain from the point where the chainwheel first passes between the side plates of the chain (see figure 6).

2.12 Spoke protector

A bicycle with rear gear change sprockets shall be fitted with a spoke protector guard to prevent the chain from interfering with or stopping the rotation of the wheel through improper adjustment or damage.

Dimensions in millimetres

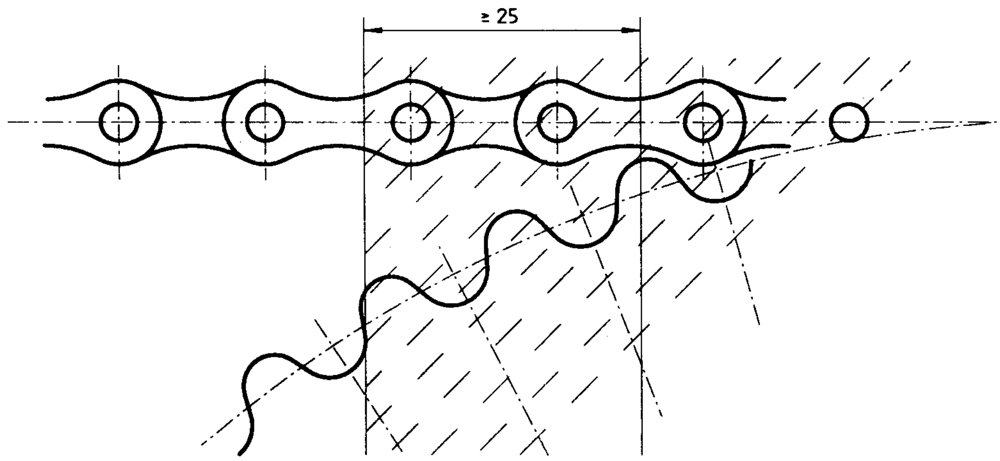


Figure 6 — Chain and chainwheel junction

2.13 Lighting

2.13.1 Lighting system

The provision of front or rear lamps, or of a complete lighting system, is not mandatory for the purposes of this International Standard, but where fitted shall comply with the requirements of ISO 6742-1.

2.13.2 Wiring harness

When a wiring harness is fitted, it shall be positioned to avoid damage by contact with moving parts or sharp edges. All connections shall withstand a tensile force in any direction of 10 N.

2.14 Reflectors

2.14.1 Rear reflectors

A bicycle equipped with a rear light in accordance with 2.13 shall be additionally equipped with a rear wide-angle reflector, or conventional reflector, meeting the requirements of ISO 6742-2. A bicycle that has no such rear light shall be equipped with a wide-angle reflector. Rear reflectors shall be red in colour.

2.14.2 Side reflectors

A bicycle shall be equipped with two side reflectors each visible from both sides. The reflectors shall be either

a) wide-angle reflectors fitted on the front half and on the rear half of the bicycle. At least one of these shall be mounted on the spokes of the wheel. Where a bicycle incorporates features at the rear wheel other than the frame and mudguard stays, the moving reflector shall be mounted on the front wheel; or

b) a continuous circle of reflective material applied to both sides of each wheel within 10 cm of the outer diameter of the tyre.

Wide-angle reflectors shall comply with the requirements of ISO 6742-2. Reflective materials shall comply with the photometric requirements of ISO 6742-2.

All side reflectors shall be of the same colour, either white (clear) or yellow.

2.14.3 Front reflectors

A bicycle shall be equipped with a front wide-angle reflector complying with the requirements of ISO 6742-2. Front reflectors shall be white (clear) in colour.

2.14.4 Pedal reflectors

Each pedal shall have reflectors complying with the requirements of ISO 6742-2, located on the front and rear surfaces of the pedal. The reflector elements shall be either integral with the construction of the pedal or mechanically attached, but shall be sufficiently recessed from the edge of the pedal, or of the reflector housing, to prevent contact of the reflector element with a flat surface placed in contact with the edge of the pedal. Pedal reflectors shall be yellow in colour.

2.15 Warning device

Where a bell or other suitable audible warning device is fitted, it shall comply with ISO 7636.

2.16 Instructions

Each bicycle shall be provided with a set of instructions containing information on:

a) preparation for riding — how to measure and adjust the seat height and handlebar height to suit the rider, with an explanation of the warning marks on the seat pillar and handlebar stem;

b) recommended tightening of fasteners related to handlebar, handlebar stem, saddle and pillar, and wheels;

c) the method for determining the correct adjustment of wheel quick release mechanisms, such as, "the mechanism should emboss the fork ends when closed to the locked position";

d) lubrication — where and how often to lubricate, and recommended lubricant;

e) the correct chain tension and how to adjust this;

f) adjustment of brakes and recommendations for replacement of brake blocks;

g) adjustment of gears;

h) appropriate spares, i.e. tyres, tubes, brake-block holder assembly;

i) accessories — where these are offered as fitted, details should be included such as operation, maintenance required (if any) and relevant spares (i.e. light-bulbs);

j) safe riding — regular checks on brakes, tyres, steering and lighting; caution concerning increased braking distance in wet weather;

k) the type of use for which the bicycle is designed (e.g. on-road or all-terrain) with a warning against the hazards of incorrect use;

l) the correct assembly of any parts supplied unassembled.

NOTE — Any other relevant information may be included at the discretion of the manufacturer.

2.17 Marking

Where a manufacturer claims compliance with this International Standard, each bicycle shall be visibly and durably marked with:

a) ISO 4210;

b) the manufacturer's or vendor's name or trademark;

c) the frame number.

Section 3: Requirements of complete bicycle

3.1 Road test

When tested by the method described in 4.10, there shall be no system or component failure and no loosening or misalignment of the seat, handlebars, control or reflectors.

The bicycle shall exhibit stable handling in turning and steering, and it shall be possible to ride with one hand removed from the handlebar (as when giving hand signals), without difficulty of operation or hazard to the rider.

Section 4: Test methods

4.1 Brake block test

The test shall be conducted on a fully assembled bicycle with the brakes adjusted to a correct position with a rider or equivalent mass on the saddle. The combined mass of bicycle and rider (or equivalent mass) shall be 100 kg ± 1 %. Each brake lever shall be actuated with a force of 180 N or a force sufficient to bring the brake lever into contact with handlebar grip, whichever is the less. Such force shall be maintained throughout the test.

The bicycle shall then be subjected to five forward and five rearwards movements, each of which is not less than 75 mm distance.

4.2 Brake system load test

4.2.1 Hand-operated brake

This test shall be conducted on a fully assembled bicycle. After it has been ensured that the braking system is correctly adjusted, a force shall be applied to the brake lever or the extension lever at a point 25 mm from the end of either type of lever, as shown in figure 7. This force shall be 450 N, or such lesser force as is required to bring:

a) a cable-brake lever into contact with the handlebar grip, or with the handlebar in the absence of a grip;

b) a cable-brake extension lever level with the upper surface of the handlebars or in contact with the handlebars;

c) a rod-operated brake lever level with the upper surface of the handlebar grip.

This test shall be repeated for a total of 10 times on each hand-brake lever and on each extension lever.

4.2.2 Back-pedal brake

This test shall be conducted on a fully assembled bicycle. After it has been ensured that the braking system is correctly adjusted, and with the pedal cranks in a horizontal position, as shown in figure 8, a force shall be applied to the centre of the left-hand pedal axle. This force shall be 1 500 N, gradually applied, in a vertical direction, and shall be maintained fully for 15 s.

This test shall be repeated for a total of 10 times.

4.3 Braking performance test

Unless otherwise stated, these requirements apply to both dry and wet test conditions.

4.3.1 Test bicycle

The braking performance test shall be conducted on a fully assembled bicycle after the brakes have been subjected to the load test detailed in 4.2. The brakes may be re-adjusted to a correct position if necessary and the tyres shall be inflated to the maximum recommended pressure, as marked on the tyre. (See 2.7.1.)

4.3.2 Test track

4.3.2.1 An indoor test track shall be used if possible. Where an outdoor track is used, special attention should be paid to ambient conditions throughout the tests.

4.3.2.2 The gradient of the track shall not exceed 0,5%. If the gradient is less than 0,2%, all runs shall be carried out in the same direction. If the gradient lies between 0,2% and 0,5%, alternate runs shall be carried out in opposite directions.

4.3.2.3 The surface shall be hard, of concrete or fine asphalt, free from loose dirt or gravel. The minimum coefficient of friction between the dry surface and the bicycle tyre shall be 0,5.

4.3.2.4 The track shall be essentially dry at the commencement of tests. When testing to the requirements of 2.2.5.1, the track shall remain dry throughout the tests.

4.3.2.5 The wind speed on the track shall not exceed 3 m/s during the tests.

Dimensions in millimetres

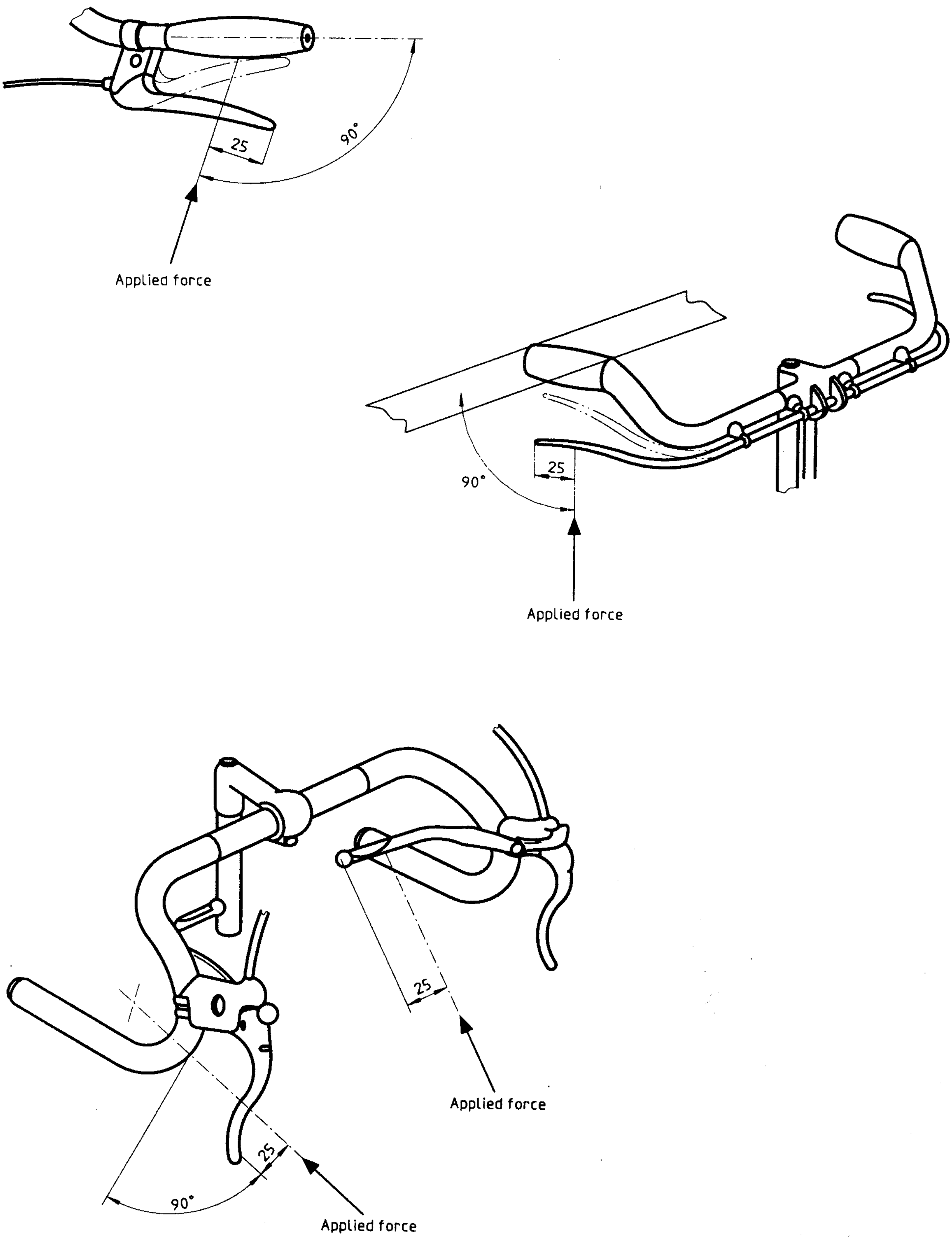


Figure 7 — Applied force on handbrake levers

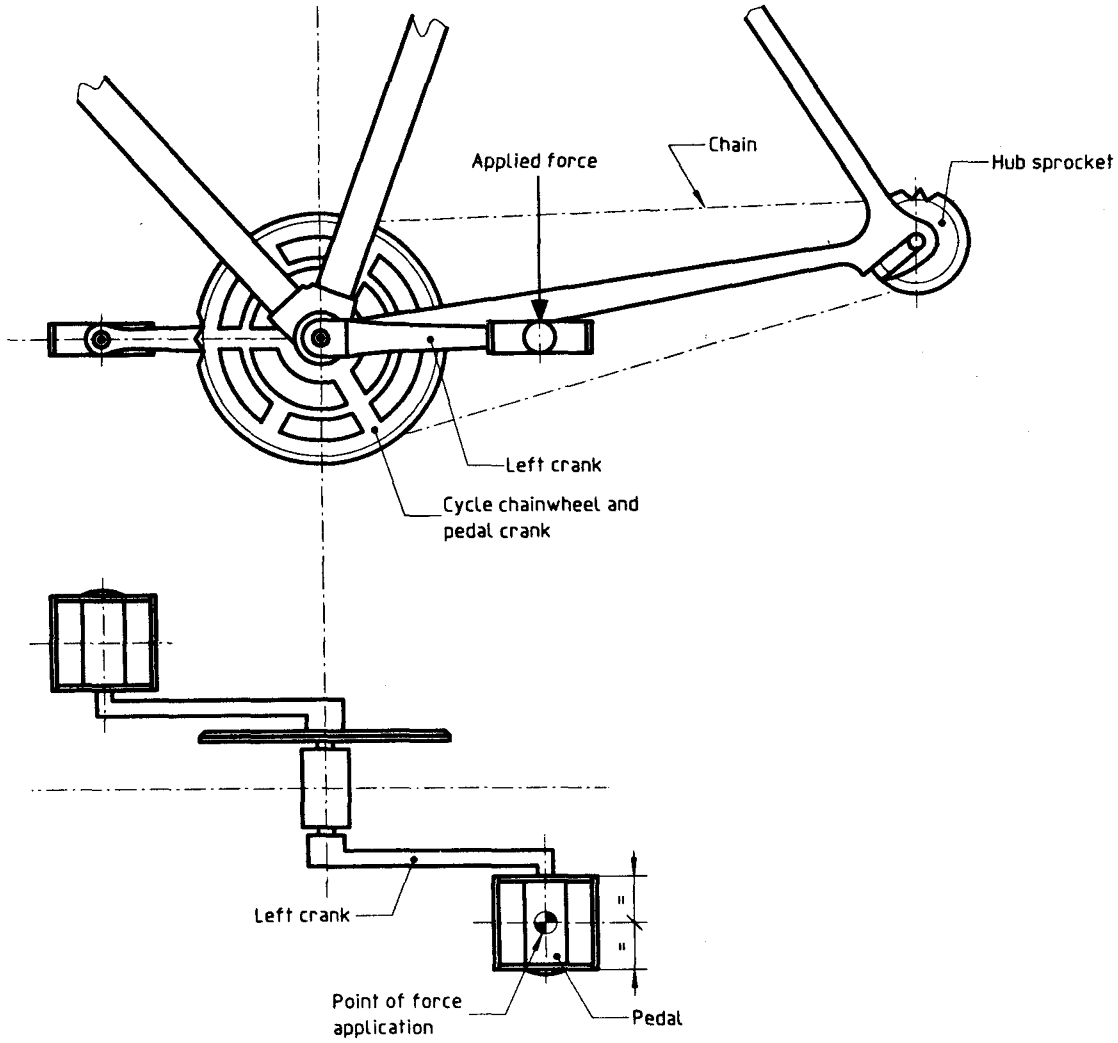


Figure 8 — Back-pedal brake test

4.3.3 Instrumentation

The test bicycle shall be instrumented to include the following.

4.3.3.1 Calibrated speedometer or tachometer, accurate to within ± 5% to indicate to the rider the approximate speed at the commencement of braking.

4.3.3.2 Velocity recording device, accurate to ± 2% to record the velocity at the commencement of braking.

4.3.3.3 Distance recording system, accurate to ± 1% to record the braking distance.

4.3.3.4 Water spray system, to provide wetting of the braking surfaces, consisting of a water reservoir connected by tubing to a pair of nozzles on the front wheel and a pair of nozzles on the rear wheel. A quick-acting on/off valve shall be included for control by the rider. Each nozzle shall provide a flow of water of not less than 4 ml/s. Distilled water at ambient temperature shall be used.

Details of the positions and directions of nozzles for caliper, internal expander, band, disc and back-pedal brakes are given in figures 9 to 14.

4.3.3.5 Brake actuation indicating system, to record independently when each brake is actuated.

4.3.4 Mass of bicycle, rider and instrumentation

The combined mass of the bicycle, the rider, and the instrumentation shall be 100 kg ± 1%.

Where a manufacturer specifies that his bicycle can carry a mass such that the total of that mass plus that of the bicycle is in excess of 100 kg, the bicycle shall be tested at that greater total mass ± 1% and it shall meet the specified braking distance.

4.3.5 Force applied to brakes

4.3.5.1 Magnitude and position of force on brake levers

Bicycles with hand-operated brakes shall be tested using a handgrip force not exceeding 180 N. The handgrip force shall be applied at a point 25 mm from the end of the lever as shown in figure 7. A check shall be carried out before and after each series of test runs to verify the lever load.

4.3.5.2 Optional brake force application device for brake levers

Where a brake lever is operated by an optional, brake-force application-device, that device shall meet the requirements of 4.3.5.1 and shall additionally control the rate of application of the brake lever force such that 63% of the applied force shall be reached in not less than 0,2 s.

4.3.5.3 Back-pedal brake

No limitation is placed on the force exerted on the pedals with a back-pedal brake.

4.3.6 Method

4.3.6.1 Test runs under dry conditions

The rider shall pedal the test bicycle until the specified test velocity is attained. He shall stop pedalling and then apply the brakes. The bicycle shall be brought to a smooth, safe stop.

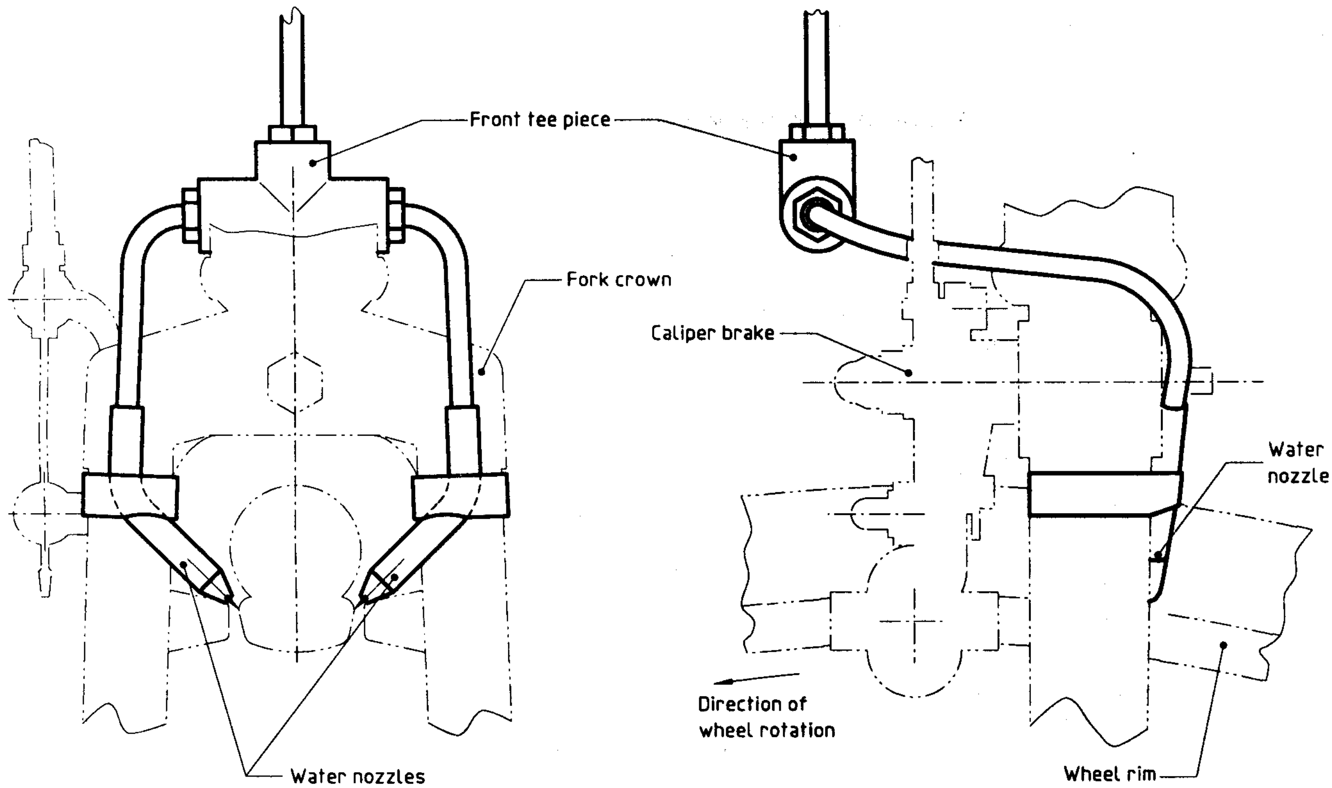


Figure 9 — Water nozzles for caliper brake (front)

Dimensions in millimetres

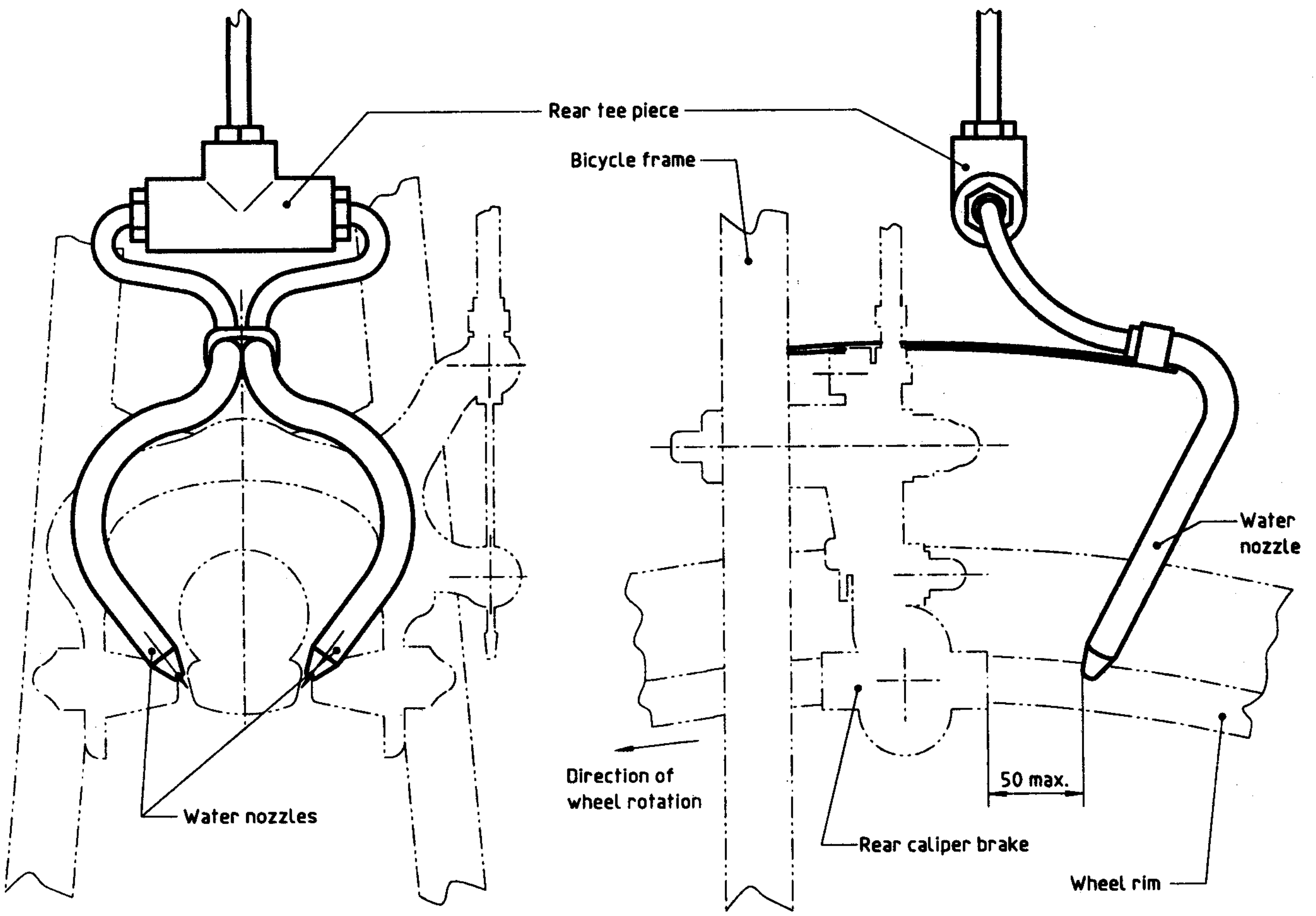


Figure 10 — Water nozzles for caliper brake (rear)

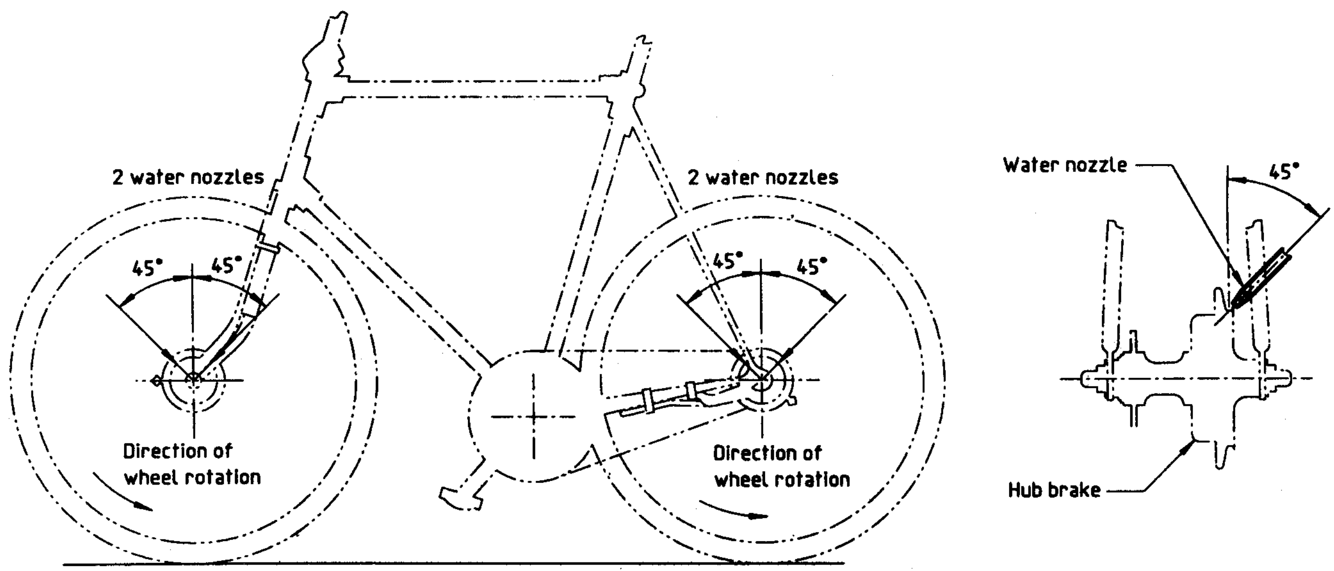


Figure 11 — Water nozzles for internal expanding brake (front and rear)

Dimensions in millimetres

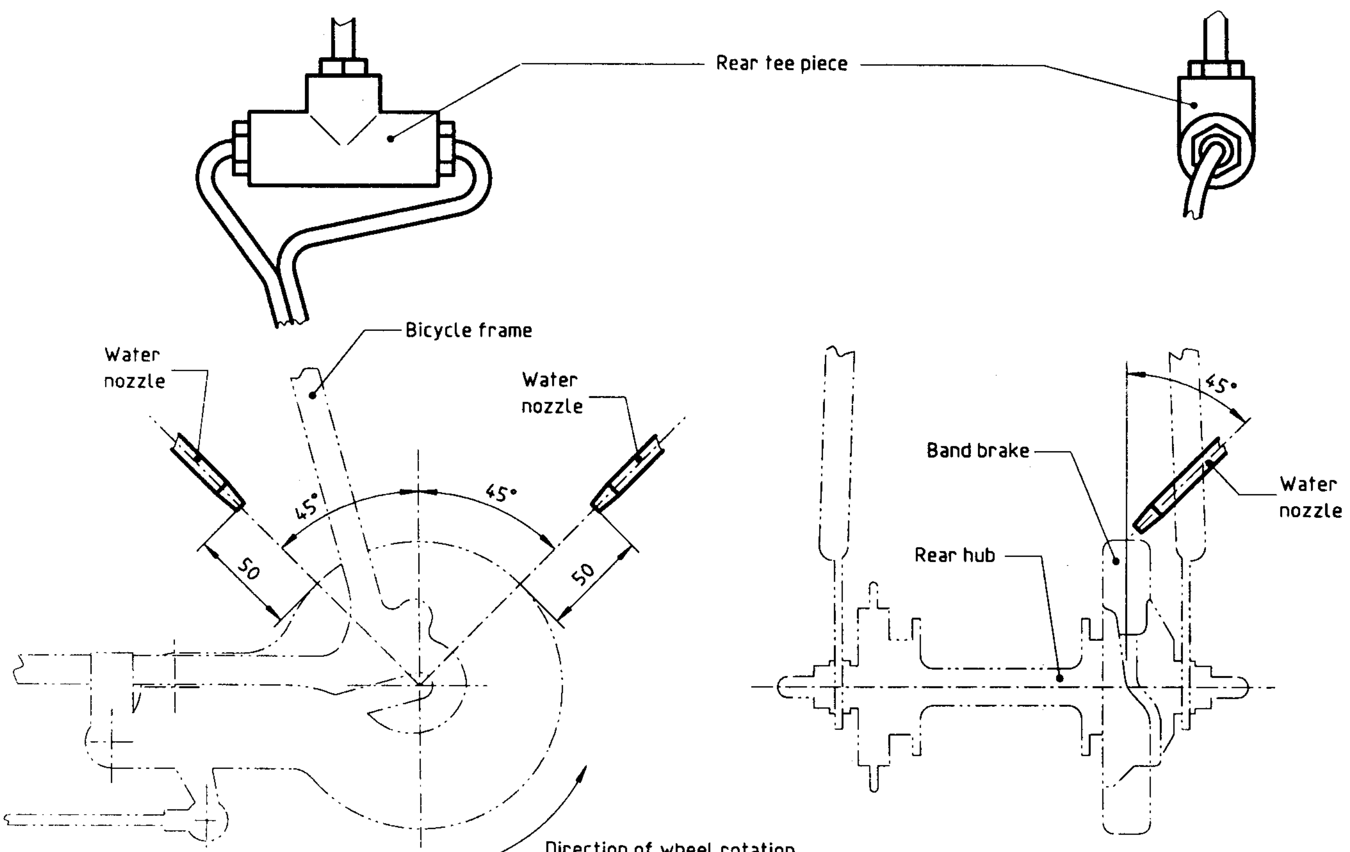


Figure 12 — Water nozzles for band brake

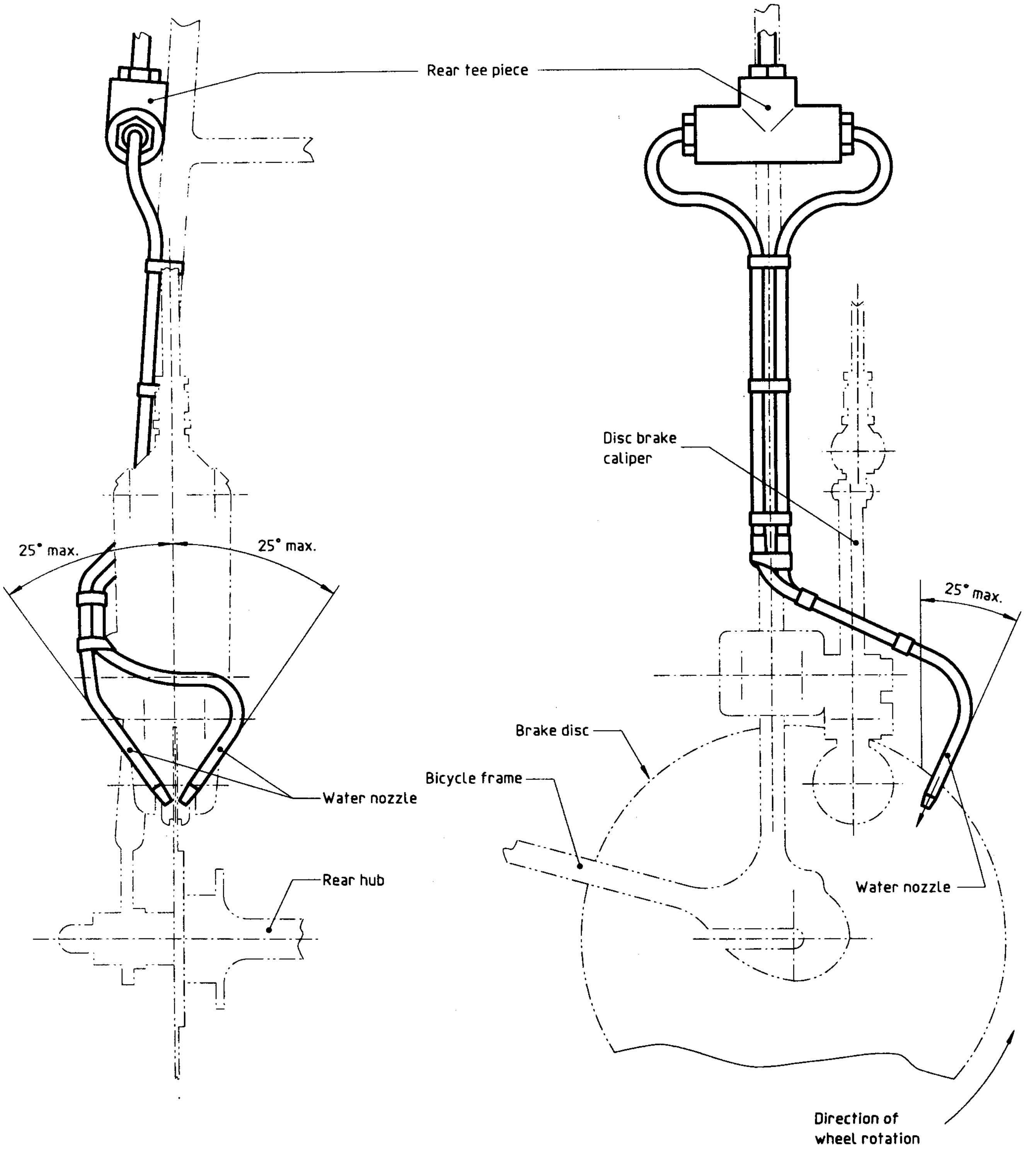
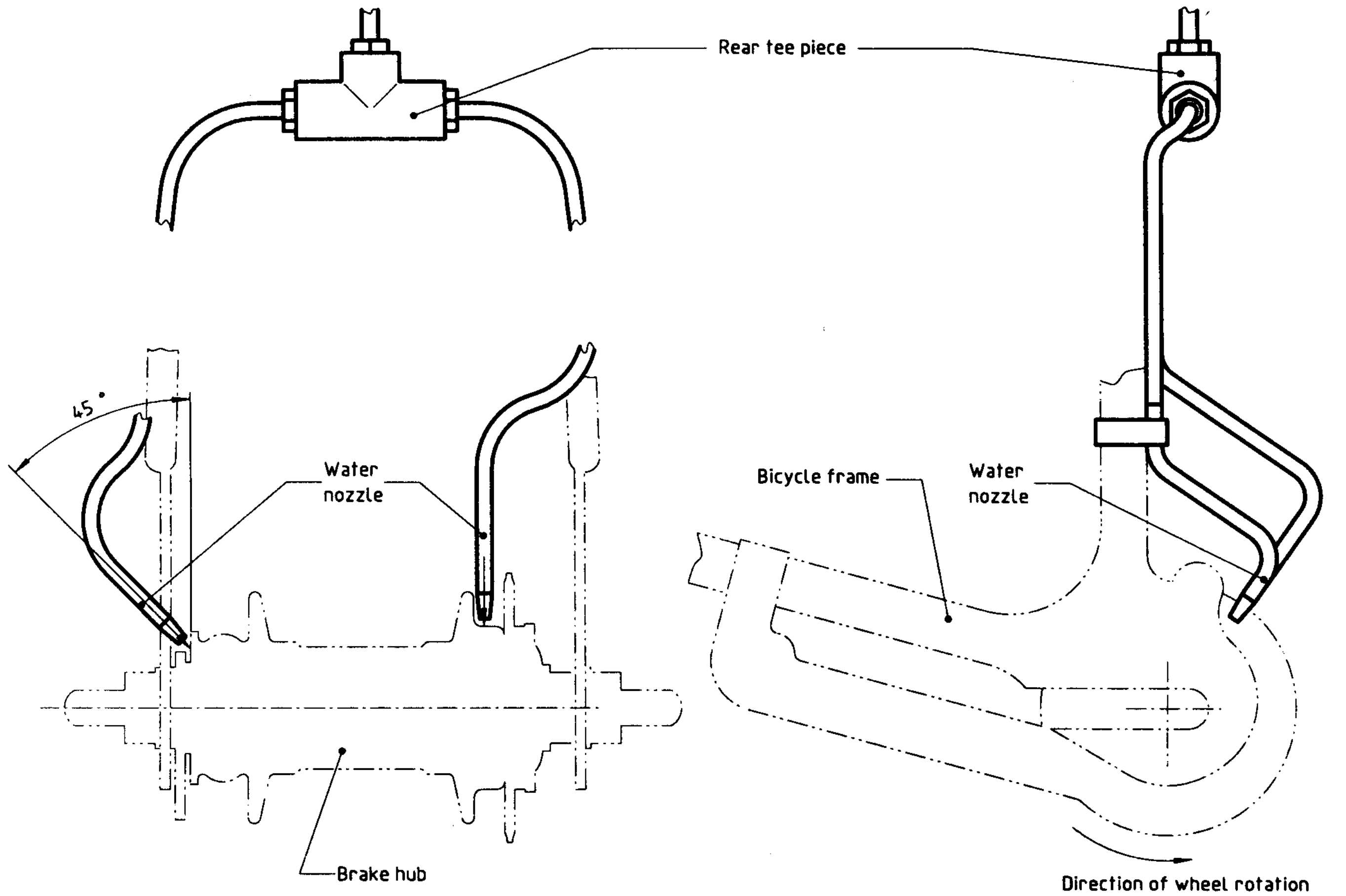


Figure 13 — Water nozzles for disc brake (rear)



NOTE — Water nozzle to be directed at hub ingress, both sides.

Figure 14 — Water nozzles for back-pedal brake

4.3.6.2 Test runs under wet conditions

The method shall be as given in 4.3.6.1, with the addition that the wetting of the brake system(s) shall commence not less than 25 m prior to the commencement of braking (1.3.7) and shall continue until the bicycle comes to rest.

NOTE — Excessive amounts of water may be swept from the test track surface between runs.

4.3.6.3 Number of valid test runs

4.3.6.3.1 If the gradient of the track is less than 0,2 % the following runs shall be made:

a) five consecutive valid runs under dry conditions;

b) two acclimatization runs under wet conditions (results not recorded);

c) five consecutive valid runs under wet conditions.

4.3.6.3.2 If the gradient of the track lies between 0,2 % and 0,5 %, the following runs shall be made:

a) six consecutive valid runs under dry conditions with alternate runs in opposite directions;

b) two acclimatization runs under wet conditions (results not recorded);

c) six consecutive valid runs under wet conditions with alternate runs in opposite directions.

NOTE — A rest period not exceeding 3 min may be taken between successive runs.

4.3.7 Velocity/distance correction factor

A correction factor shall be applied to the measured braking distance if the velocity as checked by the timing device is not precisely that specified in 2.2.5.

The corrected braking distance shall be determined from the formula:

$$S_c = \left(\frac{v_s}{v_m} \right)^2 \times S_m$$

where

S_c is the corrected braking distance, expressed in metres;

S_m is the measured braking distance, expressed in metres;

v_s is the specified test velocity, expressed in metres per second;

v_m is the measured test velocity, expressed in metres per second.

4.3.8 Validity of test runs

4.3.8.1 A test run shall be considered invalid if:

a) excessive side-skid, or

b) loss of control occurs.

With certain types of braking system, it may not be possible to avoid entirely some skidding of the rear wheel during braking; this is considered acceptable provided that a) or b) above do not occur as a result.

4.3.8.2 If the corrected braking distance exceeds the specified braking distance, a test run shall be considered invalid if:

a) the velocity at the commencement of the test exceeds the specified test velocity by more than 1,5 km/h;

b) in tests using both brakes, the front brake is activated after the rear brake;

NOTE — The front brake provides a very high percentage of retardation in the prescribed braking tests, it is therefore important that it be applied first. In order that maximum use of available braking power is utilized, it is also important that minimal delay occurs in applying the rear brake.

c) in tests using both brakes, the distance travelled by the bicycle between activation of the front and rear levers exceeds 1 m;

d) after a test run in which excessive side-skid or loss of control has occurred, a series of braking distances exceeds the specified limit.

4.3.8.3 If the corrected braking distance is less than the specified braking distance, a test run shall be considered invalid if:

a) the velocity at the commencement of braking is more than 1,5 km/h below the specified test velocity;

b) in tests using both brakes, the distance travelled by the bicycle between confirmation of the velocity and activation of the rear levers exceeds 2 m.

If the corrected braking distance exceeds the braking distance specified in table 1, the test run shall be considered valid.

4.3.9 Test results

4.3.9.1 Braking under dry conditions

Depending on the gradient of the test track, the test result shall be the average value of the corrected braking distances (see 4.3.7) of the tests runs of either 4.3.6.3.1 a) or 4.3.6.3.2 a).

For compliance with the requirements of 2.2.5.1, the above average values shall not exceed the relevant braking distances specified in table 1.

4.3.9.2 Braking under wet conditions

Depending on the gradient of the test track, the test result shall be the average value of the corrected braking distances (see 4.3.7) of the test runs of either 4.3.6.3.1 c) or 4.3.6.3.2 c).

For compliance with the requirements of 2.2.5.2, the above average values shall not exceed the relevant braking distances specified in table 1.

4.4 Back-pedal brake linearity test

This test shall be conducted on a fully assembled bicycle. The output force for a back-pedal brake shall be measured tangentially to the circumference of the rear tyre, when the wheel is rotated in the direction of forward movement, whilst a force of between 90 N and 300 N is being applied to the pedal at right angles to the crank and in the direction of braking.

The braking force reading shall be taken during a steady pull and after one revolution of the wheel. A minimum of five results, each at a different pedal force level, shall be taken. Each result shall be the average of three individual readings at the same load level.

The results shall be plotted on a graph, showing the line of best fit and the ± 20 % limit lines obtained by the method of least squares outlined in annex A.

4.5 Steering assembly test

4.5.1 Handlebar stem

4.5.1.1 Torque test

With the handlebar stem securely clamped in a fixture to the minimum insertion depth (see 2.3.2), and a test bar or handlebar assembled securely to the stem, a torque of 108 N·m shall be applied to the stem by means of the test bar in a plane parallel to the stem and in the direction shown in figure 15.

4.5.1.2 Handlebar stem bending test

With the handlebar stem securely clamped in a fixture to the minimum insertion depth (see 2.3.2), a force shall be applied through the handlebar attachment point in a forward direction and at 45° to the axis of the stem shank as shown in figure 16.

If the stem yields, it shall be capable of being bent through an angle up to 45° from the stem axis without fracture and shall support a force of not less than 1 600 N.

4.5.2 Torque test, handlebar and stem

With the stem of the handlebar assembly securely clamped to the minimum insertion depth in a fixture, a force of 220 N shall be applied simultaneously to each side of the handlebar in a direction and at the location that will provide a maximum turning moment at the junction of the handlebar and stem. Where this location occurs at the end of the handlebar, the force shall be applied as near to the end as is practicable, and in any case not further than 15 mm from the end. (See figure 17.)

NOTE — According to the shape of the handlebar, the applied loads might be in a different direction from that illustrated, in figure 17.

Where the handlebar/stem assembly is secured by means of a clamp, the torque applied to the fastener shall not exceed the torque recommended for such fasteners.

Dimensions in millimetres

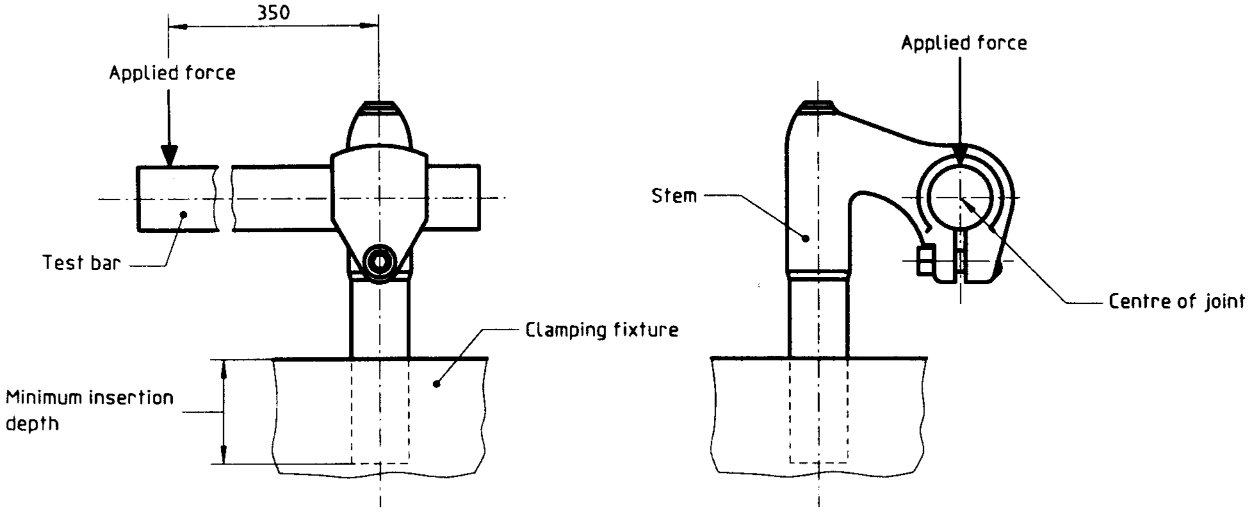


Figure 15 — Torque test on handlebar stem

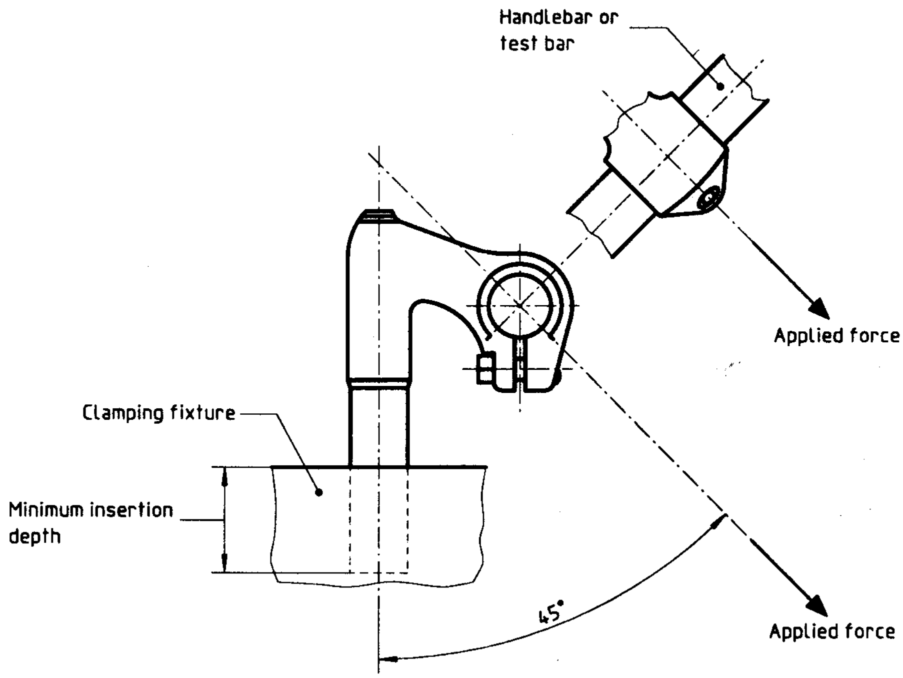


Figure 16 — Handlebar stem bending test

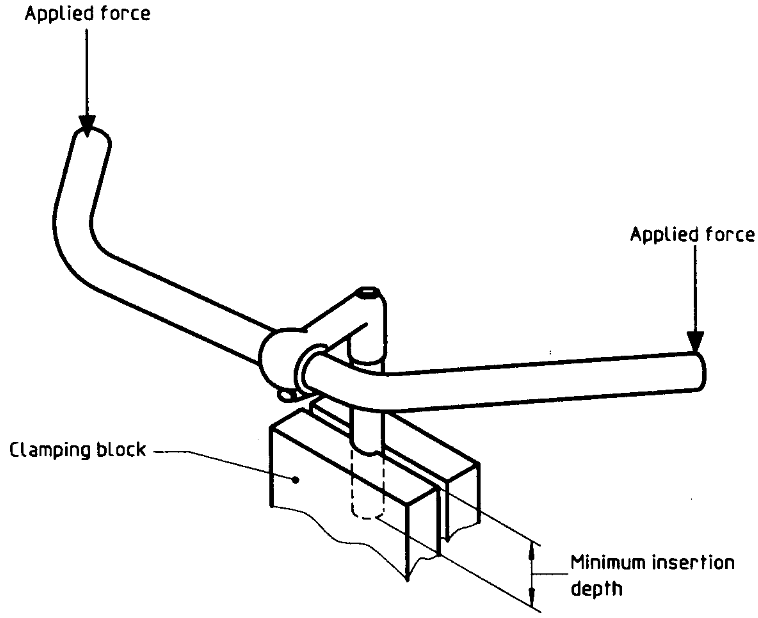


Figure 17 — Torque test on handlebar stem assembly

4.5.3 Torque test, handlebar stem and fork stem

With the handlebar stem correctly assembled in the frame and fork stem, and the expander bolt tightened in accordance with the manufacturer's instructions, a torque of 25 N·m shall be applied to the handlebar/fork clamping device, as shown in figure 18.

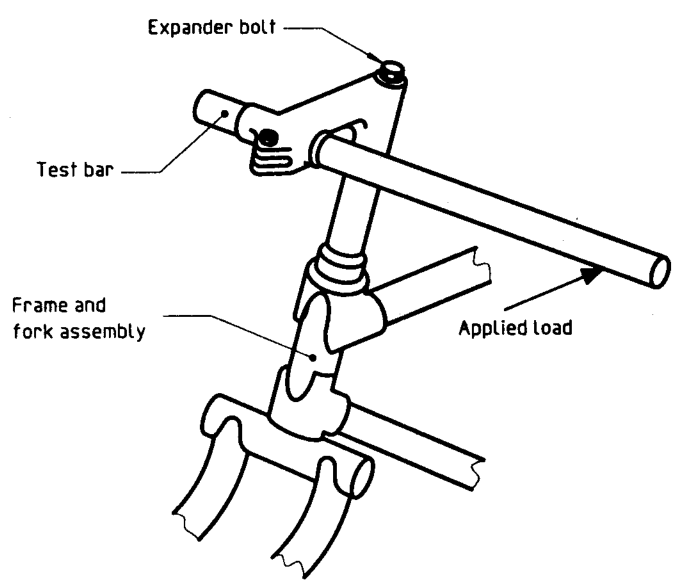


Figure 18 — Torque test on handlebar/fork clamping device

4.5.4 Fatigue test on handlebar and stem assembly

4.5.4.1 Assembly

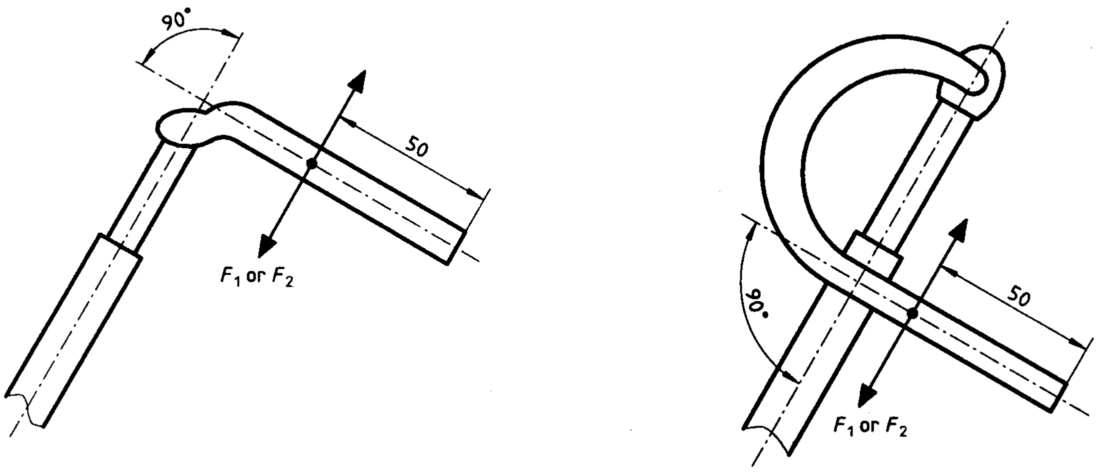
The handlebar and stem shall be in the fully-finished condition. Unless the handlebar and stem are permanently connected, e.g. by welding or brazing, the grips of a flat handlebar or drop handlebar shall be aligned in a plane perpendicular to the stem axis (see figure 19). In the case of an adjustable high-rise handlebar, the handlebar shall be located so that the axis of the handgrip is horizontal [see figure 20 b)]. The handlebar stem shall be inserted to the minimum insertion depth (see 2.3.2) and securely clamped by means of its usual fastening device in a fixture representative of that on a bicycle.

4.5.4.2 Position and direction of test forces

Dynamic test forces for handlebars other than the high-rise type shall normally be applied 50 mm from the open end of the handgrip area and parallel to the stem axis (see figure 19). For a handlebar with several possible handgrip positions (e.g. a drop handlebar), the forces shall be applied at locations to give a maximum bending moment for the assembly. For a high-rise handlebar, the forces shall be applied perpendicular to the head-tube axis and through a point 50 mm from the open end of the handgrip (see figure 20).

For the purposes of this particular test, a high-rise handlebar is defined as having a height, H, greater than 125 mm, where H is the height of the point 50 mm from the open end of the handgrip above the top of the saddle with the nose and the centre of the rear edge of the saddle horizontally aligned, and the saddle pillar and the handlebar stem at their maximum extended positions (see figure 21).

Dimensions in millimetres



a) Flat handlebar

b) Drop handlebar

Figure 19 — Orientation of adjustable handlebars and positions of applied forces

Dimensions in millimetres

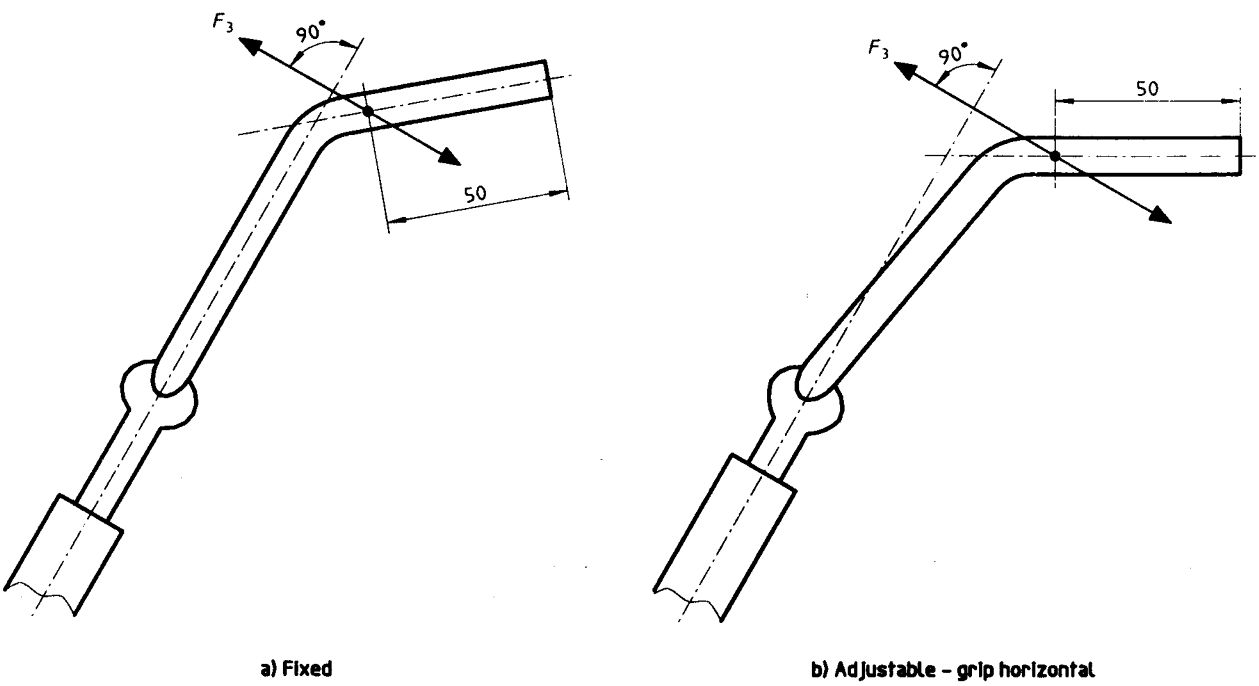


Figure 20 — High-rise handlebars; orientation of adjustable handlebar, and positions and directions of applied forces

Dimensions in millimetres

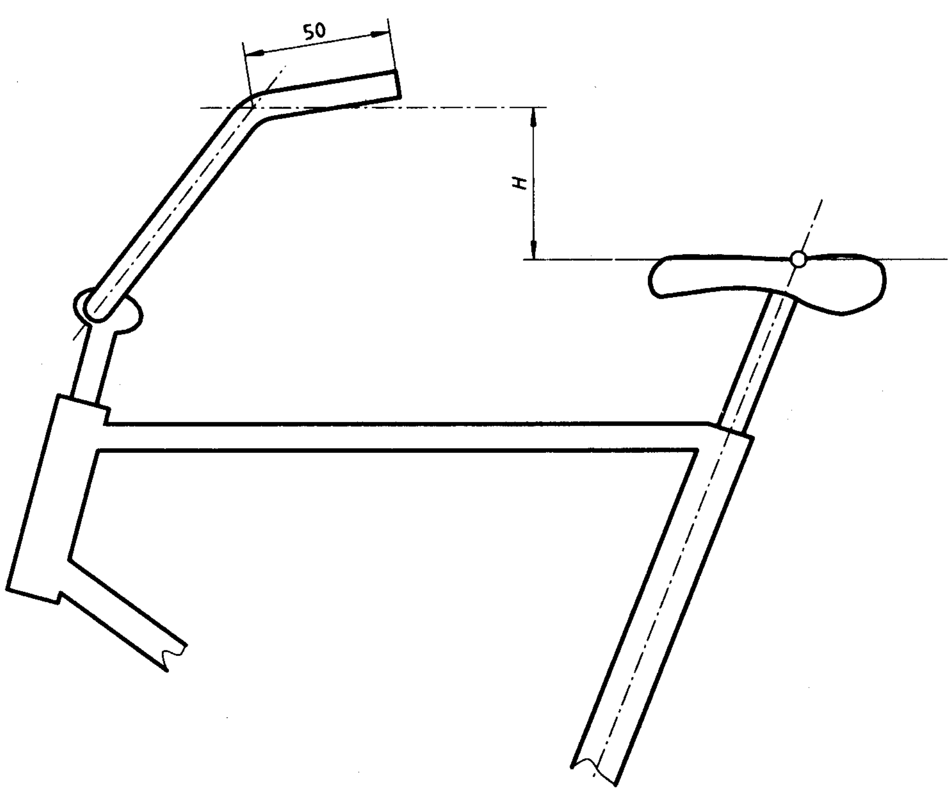


Figure 21 — High-rise handlebar; dimension H

4.5.4.3 Magnitudes of test forces, number of test cycles, and test speed

The test forces are listed in table 2.

For handlebars other than the high-rise type, a two-stage test shall be carried out on the same assembly. In the first stage, a repeated, dynamic force of F_1 shall be applied to each handgrip or hand position in phase for 50 000 cycles, and, in the second stage, a repeated, dynamic force of F_2 shall be applied to each handgrip or hand position, out of phase, for 50 000 cycles (see figure 22).

For a high-rise handlebar, a single-stage test shall be carried out with a repeated, dynamic force of F_3 applied in phase for 50 000 cycles.

The maximum test frequency shall be 25 Hz.

Table 2 — Test forces on handlebars

Values in newtons

Material	Test forces				
	Type of handlebar				
	Drop		Flat		High-rise
	In phase force, F_1	Out of phase force, F_2	In phase force, F_1	Out of phase force, F_2	In phase force, F_3
Ferrous[1)]	± 350	± 145	± 250	± 145	± 150
Non ferrous[2)]	± 450	± 200	± 350	± 200	± 210

1) See definition 1.3.11.
2) See definition 1.3.12.

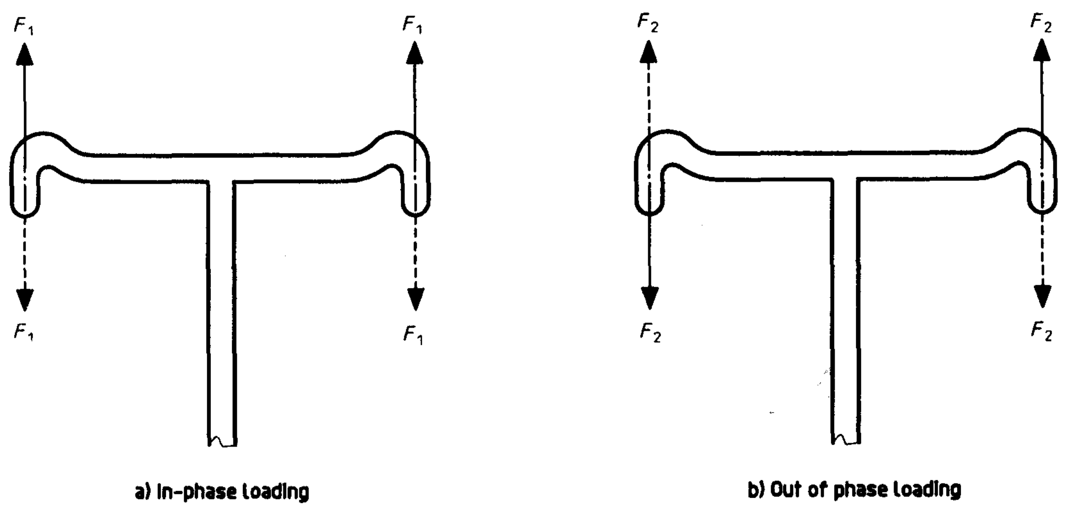


Figure 22 — In-phase and out of phase loading

4.5.4.4 Accuracy of test forces

Applied forces shall be accurate to within $^{+5}_{0}\%$ of their nominal values, as determined by suitable means of calibration traceable to national or international standards.

NOTE — Guidance on calibration can be found in ISO 9001.

4.5.5 Fatigue test on stem alone

When the fatigue test is for the stem only, the manufacturer shall specify the types and sizes of handlebar for which the stem is intended, and the test shall be based on the most severe combination.

4.6 Impact tests on frame-fork assembly

4.6.1 Falling mass test

This test shall be conducted on a frame-fork assembly. Where a frame is convertible for male and female riders by the removal of a bar, it shall be tested with the bar removed. The wheelbase shall be measured. A roller of mass, less than or equal to 1 kg, and dimensions conforming to those shown in figure 23 shall be assembled in the front fork. The frame-fork assembly shall be held vertically and clamped to a rigid fixture by the rear axle attachment points as shown in figure 23.

A mass of 22,5 kg shall be dropped vertically through a height of 180 mm so as to strike the low-mass roller at a point in line with the wheel centres and against the direction of the fork rake.

4.6.2 Falling frame-fork assembly test

The test shall be conducted on the frame-fork and roller assembly used for the test in 4.6.1.

The assembly shall be mounted at the rear axle attachment points so that it is free to rotate about the rear axle, in a vertical plane. The front fork shall be supported by a flat steel anvil so that the frame is in its normal position of use. A mass of 70 kg shall be securely fixed to the saddle pillar with its centre of gravity on the axis of, and 75 mm from the top face of the seat tube when measured along the seat tube axis. The assembly shall be rotated about the rear axle so that the centre of gravity of the 70 kg mass is vertically above the rear axle, and then allowed to fall freely to impact on the anvil. (See figure 24.)

The test shall be repeated to provide a total of two such impacts.

4.6.3 Fatigue test on fork

4.6.3.1 Assembly

The fork shall be in the fully-finished condition.

The fork shall be mounted in a fixture representative of the head tube and gripped in the normal bearings.

4.6.3.2 Position and direction of test force

A fully-reversed, dynamic force shall be applied in the plane of the wheel and perpendicular to the stem tube to a loading attachment and swivel on an axle located in the axle-slots of the blades (see figure 25).

4.6.3.3 Magnitudes of test forces, number of test cycles, and test speed

For forks manufactured of ferrous materials (see 1.3.11), a force of $\pm$ 440 N shall be applied for 50 000 test cycles.

For forks manufactured of non-ferrous materials (see 1.3.12) or incorporating structural elements of non-ferrous materials, a force of $\pm$ 600 N shall be applied for 50 000 test cycles.

The maximum test frequency shall be 25 Hz.

4.6.3.4 Accuracy of test forces

Applied forces shall be accurate to within ${}^{+5}_{\ 0}\,\%$ of their nominal values, as determined by suitable means of calibration traceable to national or international standards.

Dimensions in millimetres

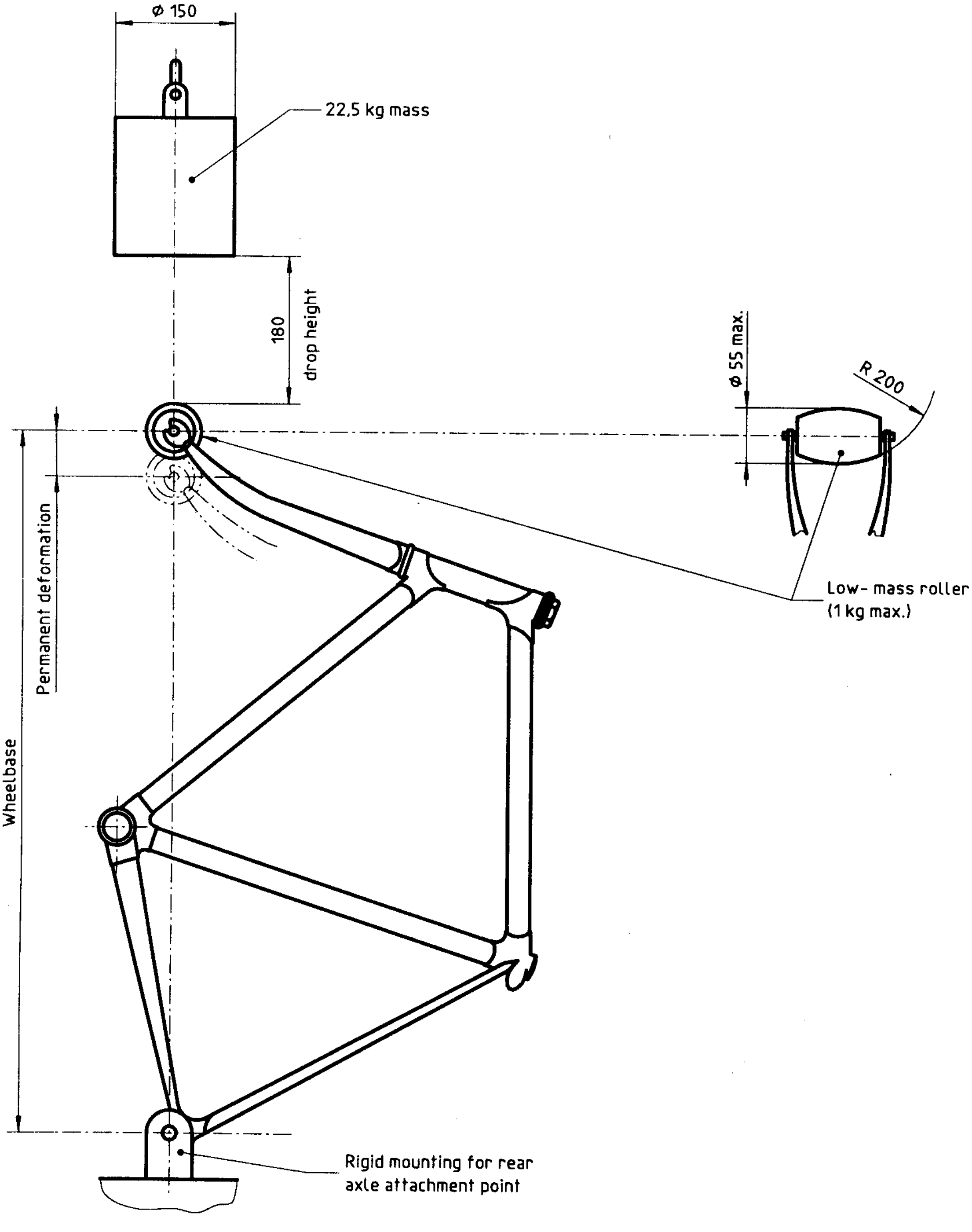


Figure 23 — Impact test (falling mass)

Dimensions in millimetres

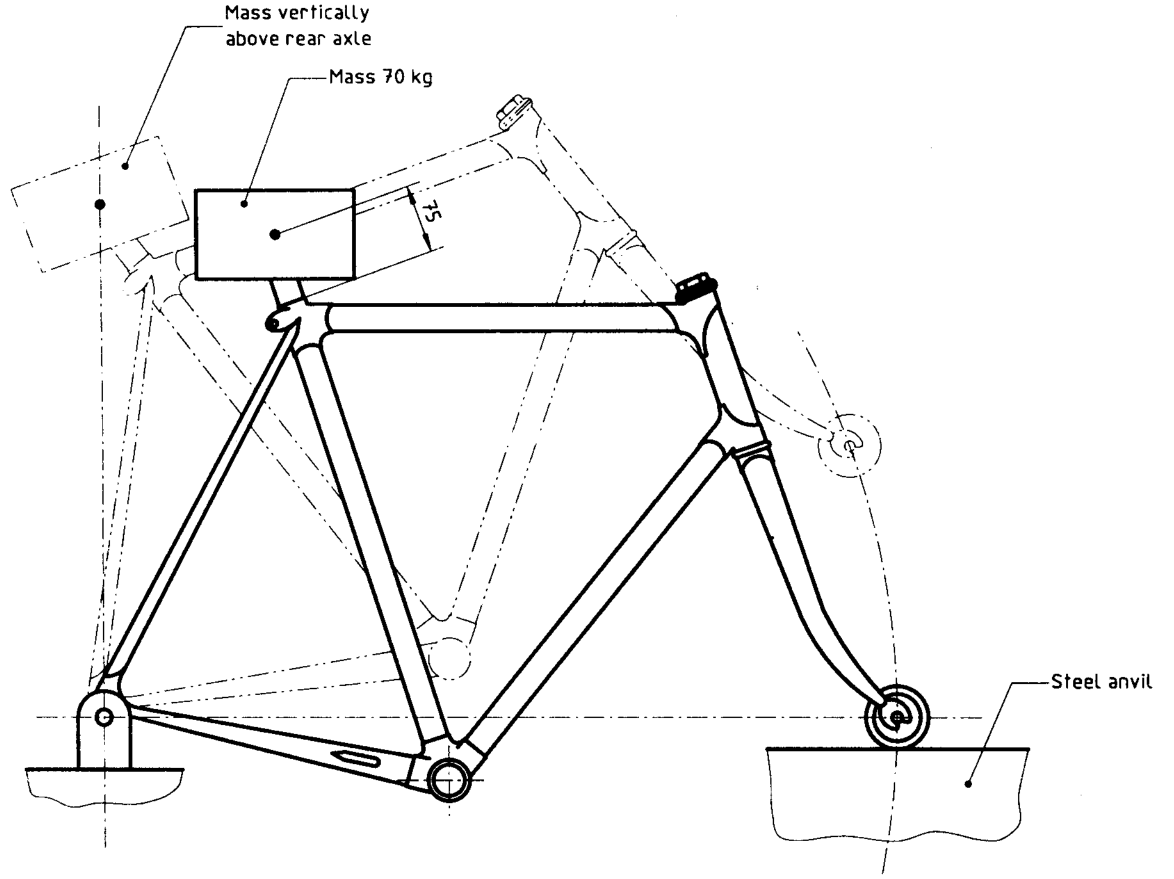


Figure 24 — Impact test (falling frame-fork assembly)

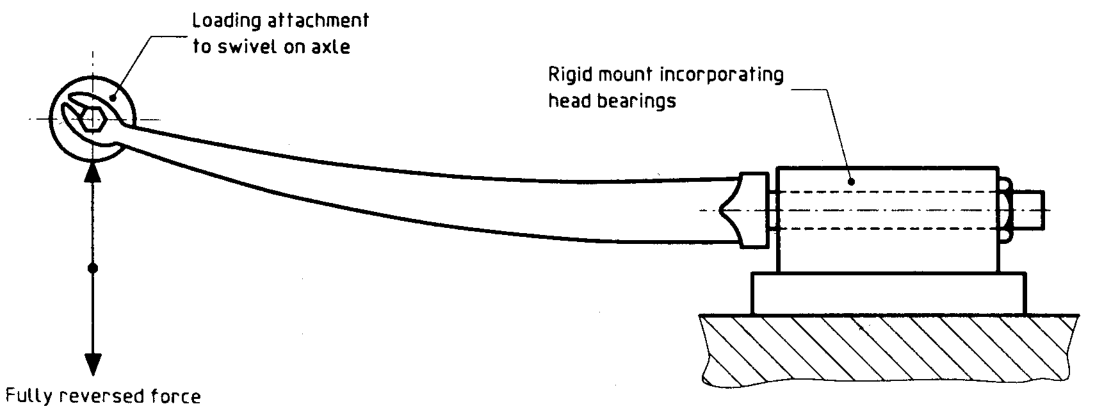


Figure 25 — Typical test arrangement for a fork

4.7 Static load test (wheel)

With the wheel suitably supported and clamped in position, as shown in figure 26, a force of 178 N shall be applied at one point on the wheel rim, perpendicular to the plane of the wheel. The force shall be applied once only for a duration of 1 min.

If the wheel hub is offset, the force shall be applied in the direction shown in figure 26.

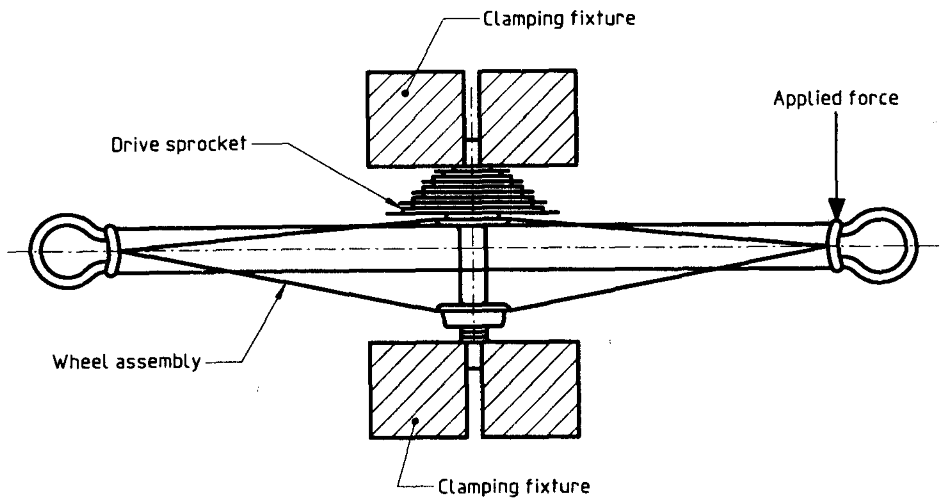


Figure 26 — Static load test on wheel

4.8 Pedal tests

4.8.1 Drive system static load test

The test shall be conducted on an assembly comprising frame, pedals, transmission system, rear wheel assembly and, where appropriate, the gear change mechanism. The frame shall be supported with its longitudinal plane vertical, and with the rear wheel clamped securely at the rim to prevent the wheel rotating.

4.8.1.1 Single speed system

4.8.1.1.1 With the left-hand crank in the forward horizontal position, a force of 1 500 N shall be gradually applied vertically downwards to the centre of the left-hand pedal.

The force shall be maintained for 15 s.

Should the system yield or the drive sprockets tighten such that the crank rotates while under load to a position more than 30° below horizontal, the crank shall be returned to horizontal, or to some appropriate position above horizontal to take account of system yield, and the test repeated.

4.8.1.1.2 On completion of the test in 4.8.1.1.1, the test shall be repeated with the right-hand crank in the forward horizontal position and the load applied to the centre of the right-hand pedal.

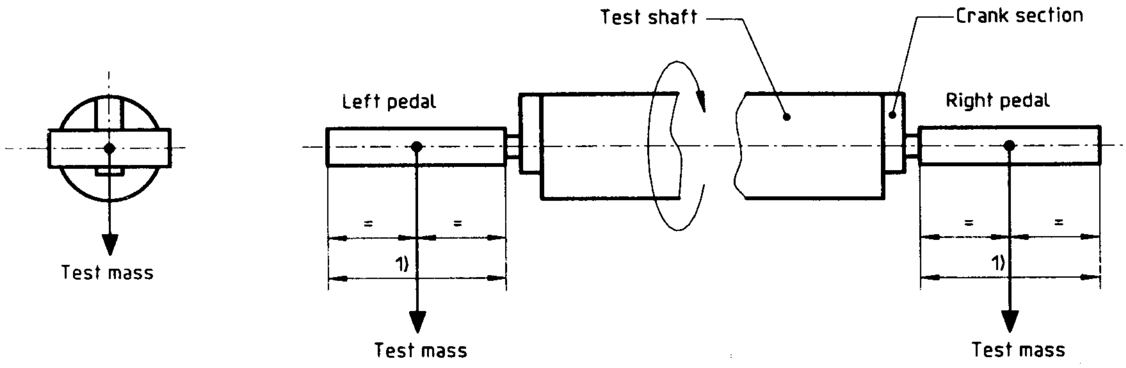
4.8.1.2 Multispeed system

4.8.1.2.1 The test given in 4.8.1.1.1 shall be conducted with the transmission correctly adjusted in its highest gear.

4.8.1.2.2 The test given in 4.8.1.1.2 shall be conducted with the transmission correctly adjusted in its lowest gear.

4.8.2 Pedal dynamic durability test

With suitable sections cut from a pair of cranks fitted securely to a test shaft, assemble a pair of pedals to the crank sections. A mass totalling 50 kg shall be suspended from each pedal by means of a spring to minimize oscillation of the load, as shown in figure 27. The shaft shall then be driven at approximately 100 min^{-1} for a total of 1 000 000 revolutions. After 500 000 revolutions, the pedals shall be turned through 180° if they are provided with two treads.



1) Width of tread surface.

Figure 27 — Pedal dynamic durability test

4.8.3 Fatigue test on crank assembly

4.8.3.1 Assembly

All of the components under test shall be in the fully-finished condition.

The two pedal spindles, the two cranks, the chainwheel (or other drive component), and the bottom-bracket spindle located on its normal-production bearings shall be mounted in a fixture with bearing-housings representative of the bottom-bracket, as shown in figure 28. The cranks shall be inclined to the horizontal at an angle of 45°.

Rotation of the assembly shall be prevented by a suitable length of transmission chain located around the chainwheel and firmly secured to a suitable support or by the first stage of any other type of transmission being secured (e.g. belt or shaft drive).

4.8.3.2 Position and direction of applied test forces

Repeated vertical, dynamic forces shall be applied alternately to the pedal-spindles of the left- and right-hand cranks at a distance of 65 mm from the outboard face of each crank, as shown in figure 28. The direction of the force on the right-hand crank shall be downwards and that on the left-hand shall be upwards.

NOTE — If the pedal spindle is less than 65 mm in length, a simulated test spindle or adaptor may be used so that the force may be applied 65 mm from the face of the crank arm.

4.8.3.3 Magnitudes of test forces, number of test cycles, and test speed

For assemblies of components made entirely of ferrous materials (see 1.3.11) a force of 1 100 N shall be applied to each crank for 50 000 cycles (where one test cycle consists of the application of the two forces).

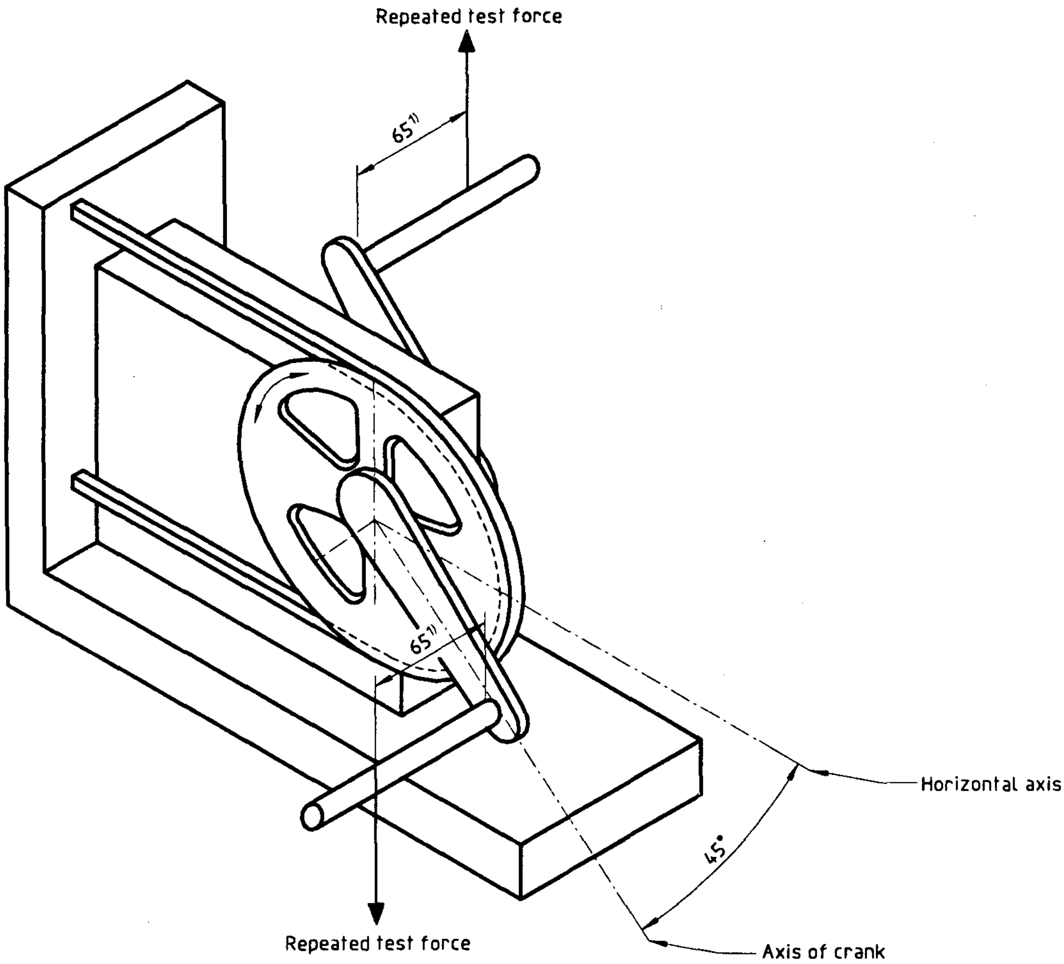
For assemblies including components made of non-ferrous materials (see 1.3.12) a force of 1 400 N shall be applied to each crank for 50 000 cycles (where one test cycle consists of the application of the two forces).

The maximum test frequency shall be 25 Hz.

4.8.3.4 Accuracy of test forces

Applied forces shall be accurate to within ${}^{+5}_{\ 0}\,\%$ of their nominal values, as determined by suitable means of calibration traceable to national or international standards.

Dimensions in millimetres



1) From outboard face of crank.

Figure 28 — Typical test arrangement for a crank assembly

4.9 Saddle and saddle pillar tests

4.9.1 Static load test (saddle and saddle pillar)

With the saddle and saddle pillar correctly assembled to the frame, and the clamps tightened to the torque recommended for such fasteners, a force of at least 668 N shall be applied vertically downwards at a point within 25 mm from either the front or rear of the saddle, whichever produces the greater torque on the saddle clamp. After removal of this force, a lateral force of 222 N shall be applied horizontally to a point within 25 mm from either the front or rear of the saddle, whichever produces the greater torque on the clamp. (See figure 29.)

4.9.2 Saddle strength test

With the saddle clamped to a fixture and the clamps tightened to the torque recommended for such fasteners, a force of 400 N shall be applied in turn under the rear and nose of the saddle cover, as shown in figure 30. The force shall not to be applied to any part of the steel chassis of the saddle.

4.9.3 Fatigue test on saddle pillar

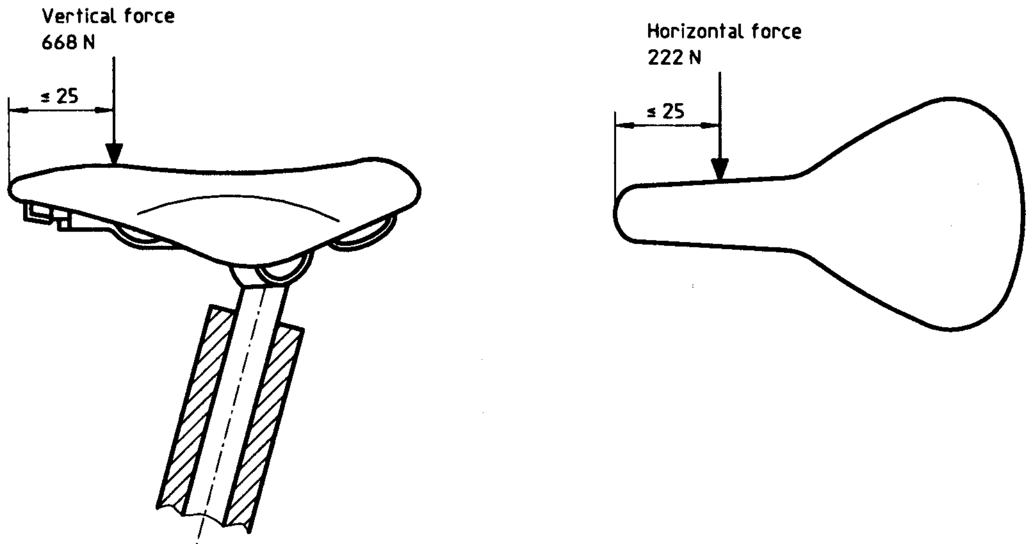
4.9.3.1 Assembly

The test components shall be in the fully-finished condition.

The saddle pillar shall be inserted to the minimum insertion depth (see 2.9.2) and securely clamped by means of its usual fastening device in a fixture representative of that on a bicycle.

The axis of the saddle pillar shall be inclined at 73° to the horizontal (see figures 31 and 32).

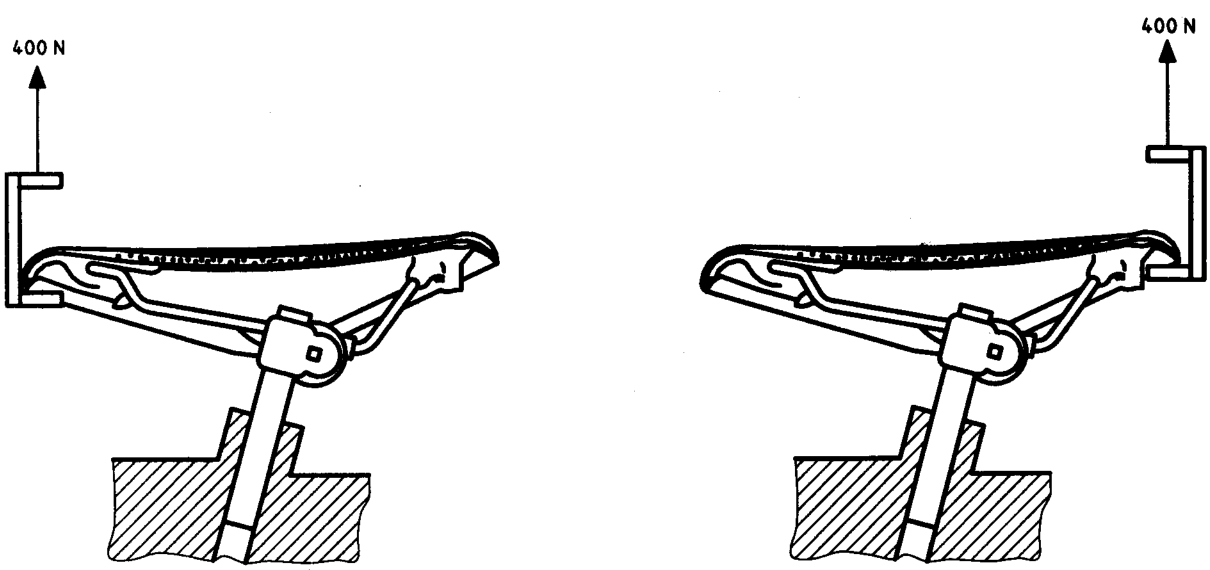
Dimensions in millimetres



a) Vertical force

b) Horizontal force

Figure 29 — Static load test



a) Force under nose

b) Force under rear

Figure 30 — Saddle strength test

Dimensions in millimetres

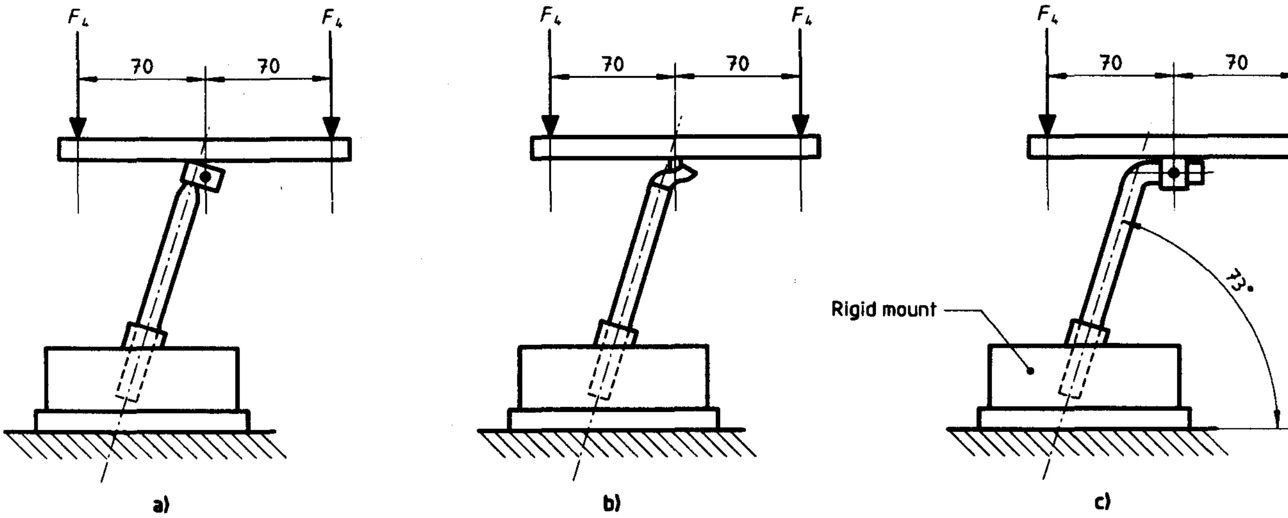


Figure 31 — Typical arrangements of different types of saddle pillar for the first stage of test (the angle of 73° applies to all)

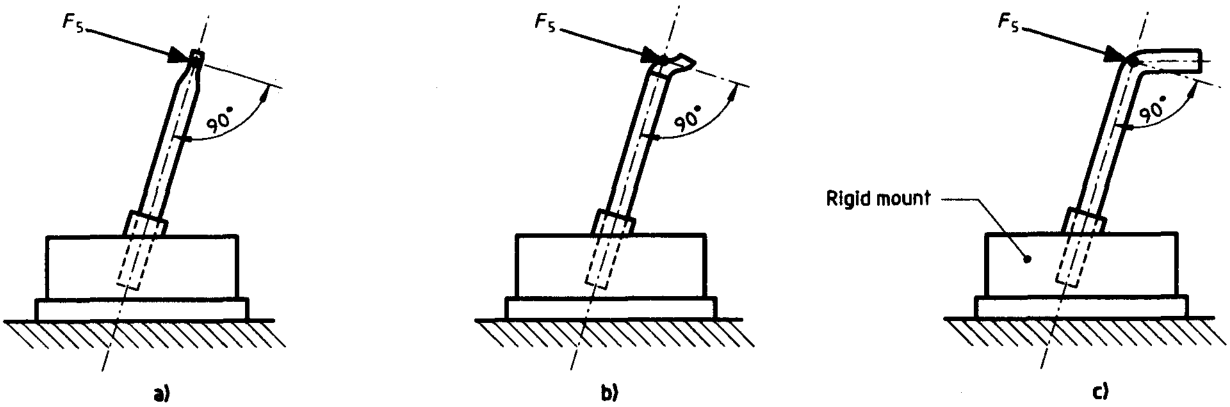


Figure 32 — Typical arrangements of different types of saddle pillar for the second stage of test

4.9.3.2 Position and directions of test forces

The saddle pillar shall be subjected to two stages of dynamic loading, the respective directions of loading being as shown in figures 31 and 32.

In the first stage, a repeated, vertical downward force, F_4, shall be applied alternatively to each end of a suitable test adaptor which represents a saddle and which is securely clamped to the saddle pillar (see figure 31). The adaptor shall be clamped to the top portion where the saddle clamp would fit, and the mid-span of the adaptor shall be located in the clamp bolt position. The test forces shall be applied 70 mm ahead and 70 mm to the rear, respectively, of midspan.

For a saddle pillar with a choice of horizontal positions for the clamp, the adaptor shall be located in the rearmost position.

In the second stage, a repeated, rearward force, F_5, shall be applied at 90° to the main axis of the pillar. For a straight pillar, the force shall be applied through the centre of that position of the tube intended for the saddle clamp [see figure 32 a), and for a pillar with a horizontal extension the force shall be applied through the intersection of the axes of the main tube and the extension [see figures 32 b) and c)].

4.9.3.3 Magnitudes of test forces, number of test cycles, and test speed

The test forces are given in table 3.

In each stage, forces shall be applied for 50 000 cycles where a cycle represents the application of the two alternating forces in the first stage and the application of the single force in the second stage.

The maximum test frequency shall be 25 Hz.

Table 3 — Test forces on saddle pillar

Material	Test force N	
	F_4	F_5
Ferrous[1)]	850	650
Non-ferrous[2)]	1 200	900

1) See definition 1.3.11.

2) See definition 1.3.12.

4.9.3.4 Accuracy of test forces

Applied forces shall be accurate to within $^{+5}_{0}$ % of their nominal values, as determined by suitable means of calibration traceable to national or international standards.

4.10 Road test

Each bicycle selected for the road test shall first be checked and adjusted if necessary to ensure that the steering and wheels rotate freely without slackness, that brakes are adjusted correctly and do not impede wheel rotation. Wheel alignment shall be checked and corrected if necessary and tyres inflated to the recommended pressure as marked on the sidewall of the tyre. Drive chain adjustment shall be checked and corrected if necessary and any gear control fitted shall be checked for correct and free operation.

The saddle and handlebar positions shall be carefully adjusted to suit the rider.

The bicycle shall be ridden for at least 1 km by a rider of appropriate size.

During the test, the bicycle shall be ridden five times over a course, 30 m in length, consisting of wooden strips measuring 50 mm wide and 25 mm high with a 12 mm by 45° chamfer on the corners contacting the tyres. The strips shall be spaced every 2 m over the 30 m course. The bicycle shall be ridden over this course at speeds consistent with those indicated in 2.2.5.2.

Annex A
(informative)

Explanation of method of least squares for obtaining line of best fit and ± 20 % limit lines for back-pedal brake linearity test

The readings taken in the test specified in 4.4 can be expected to lie near some straight line that can be drawn through them. Although in practice one might draw a good straight line through the points by eye, the method of least squares given here provides a criterion for minimizing the discrepancies, and permits a line to be selected that has a claim to be called the best fit.

The line of best fit is the line that minimizes the sum of the squares of the differences between the observed results and the corresponding results predicted by the line.

The relationship between the variables is considered to be of the form:

$$y = a + bx$$

where

x is the independent variable, and is known precisely (in this case the load applied to the pedal);

y is the dependent variable, and is observed but with a degree of uncertainty (in this case, the braking force at the wheel);

a and b are unknown constants and have to be estimated.

For a series of n readings, this relationship can be resolved by taking a minimum of the sum of the squares of the difference to give:

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \sum x \sum x}$$

Taking:

$$\bar{y} = \frac{\sum y}{n} \text{ and } \bar{x} = \frac{\sum x}{n}$$

$$b = \frac{\sum xy - \bar{y}\sum x}{\sum x^2 - \bar{x}\sum x}$$

Then a may be found by substitution:

$$a = \bar{y} - b\bar{x}$$

EXAMPLE

The following four values of x and y are noted during a test, from which $\sum xy, \sum x^2, \bar{x}$ and $\bar{y}$ are calculated as shown:

No.	x (pedal force) N	y (braking force) N
1	90	90
2	150	120
3	230	160
4	300	220
Sum	$\sum x = 770$	$\sum y = 590$
Mean	$\bar{x} = 192{,}5$	$\bar{y} = 147{,}5$

No.	xy	x^2
1	8 100	8 100
2	18 000	22 500
3	36 800	52 900
4	66 000	90 000
Sum	$\sum xy = 128\,900$	$\sum x^2 = 173\,500$

$$
\begin{aligned}
b &= \frac{\sum xy - \bar{y}\sum x}{\sum x^2 - \bar{x}\sum x} \\
&= \frac{128\,900 - (147{,}5 \times 770)}{173\,500 - (192{,}5 \times 770)} \\
&= 0{,}606 \\
a &= \bar{y} - b\bar{x} \\
&= 147{,}5 - (0{,}606 \times 192{,}5) \\
&= 30{,}8
\end{aligned}
$$

The line of best fit is therefore:

$$y = 30{,}8 + 0{,}606x$$

and the ± 20 % limit lines are:

$$
\begin{aligned}
y_{\text{lower}} &= \frac{80}{100}(30{,}8 + 0{,}606x) \\
&= 24{,}64 + 0{,}485x \\
y_{\text{upper}} &= \frac{120}{100}(30{,}8 + 0{,}606x) \\
&= 36{,}96 + 0{,}727x
\end{aligned}
$$

The results are shown graphically in figure A.1.

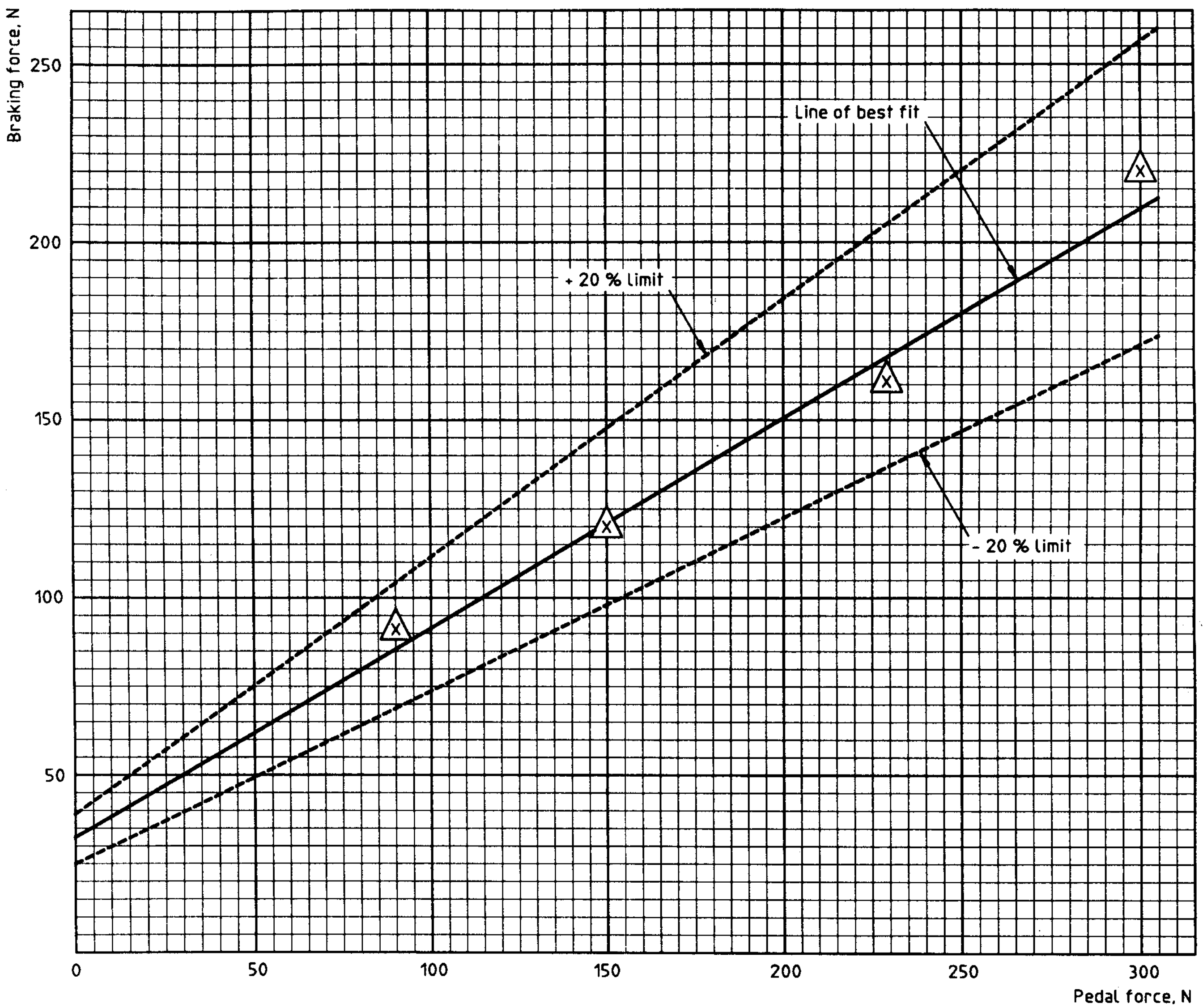


Figure A.1 — Graph of pedal force against braking force, showing line of best fit and ± 20 % limit lines

Annex B
(informative)

Steering geometry

The steering geometry employed, as shown in figure B.1, will generally be dictated by the use for which the bicycle is intended but it is nevertheless recommended that

a) the steering head angle be not more than 75° and not less than 65° in relation to the ground line; and

b) the steering axis intersects a line perpendicular to the ground line, drawn through the wheel centre, at a point not lower than 15% and not higher than 60% of the wheel radius when measured from the ground line.

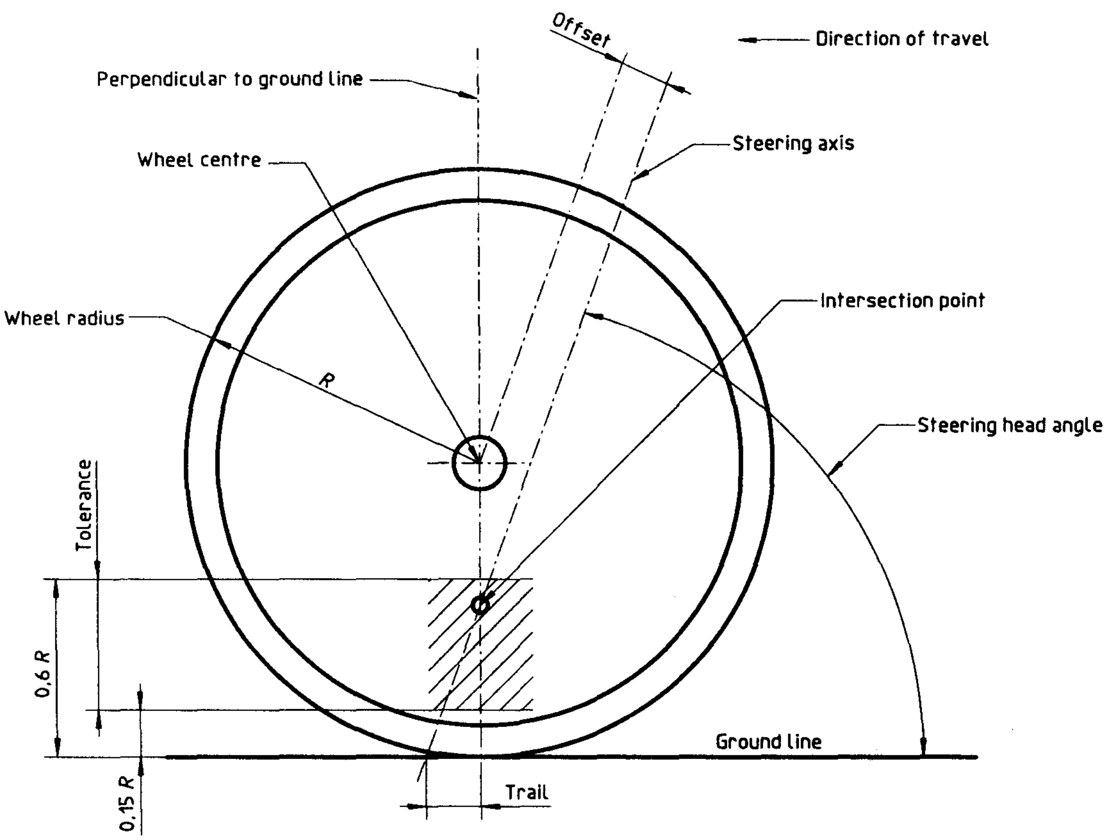


Figure B.1 — Steering geometry

Annex C
(informative)

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[2] ISO 3452:1984, *Non-destructive testing — Penetrant inspection — General principles.*

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